The archaeology of the coastal desert of Namaqualand, South Africa: a regional synthesis

by
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Abstract

The purpose of this thesis was to study human adaptation in a desert environment during the Later Stone Age. Nine open-air sites from the coastal desert of Namaqualand, South Africa were excavated and analysed with the focus on identifying settlement patterns and subsistence strategies within the context of a desert environment. Using radiocarbon dates and palaeoenvironmental indices, it was noted that most occupation of the region is linked to periods that were cooler and wetter than today. There is more evidence for occupation after the mid-Holocene warm phase, although there is a notable dearth of sites dating to the Medieval Warm Epoch, and a significant increase during the Little Ice Age. Using faunal and stable isotope analysis, it was found that people ate mixed diets that included both marine and terrestrial species; there is little evidence of heavy reliance on marine food as documented elsewhere along the South African coastline in the late Holocene. The overwhelming dominance of short-stay sites with limited ranges of artefacts suggest that settlement patterns were very mobile, with the paucity of water as a potential catalyst. While people from other areas dealt with increasing population pressure in recent millennia by becoming more sedentary and perhaps utilising delayed-returns strategies, there is little evidence to suggest that the carrying capacity of Namaqualand was being tested. In addition, this region has been suggested as one of the points of entry for pastoralism and pottery into South Africa. There is, however, no evidence for substantial changes in economy or material culture in the last 2000 years, so these items probably arrived at the Namaqualand coast through diffusion rather than migration. In addition, this research has, for the first time, identified special-purpose sites where people mass harvested springbok (*Antidorcas marsupialis*), African penguins (*Spheniscus demersus*) and angulate tortoises (*Chersina angulata*). There is also evidence for intentional human hunting/collecting of micromammals, so that humans should be included in the classification system developed by Andrews (1990) as a category 5 predator. Finally, the locations of a prehistoric Cape fur seal (*Arctocephalus pusillus*) rookery and an African penguin hatchery were identified, which will be of value to long-term ecological studies.

Acknowledgements

This project could not have been completed without the contributions of many people; I have come a long way in understanding southern African archaeology since it began. In particular, I want to thank my advisor Judith Sealy, who assisted me in many ways, from letting me stay with her when I first arrived in Cape Town, to contributing ideas, to being my editor, amongst many other things, so to her I owe the greatest thanks. I could not have even begun this project without the many years of hard work of members of the Archaeology Contracts Office: Dave Halkett, Jayson Orton, and Tim Hart, first by walking around in the Sandveld in the blasting wind, and then excavating in extreme weather. In particular, I thank Dave Halkett, with whom I have worked with most closely, toasting sandwiches at tea whilst discussing the artefacts and theories, and Jayson Orton for contributing his time in analysing the stone artefacts. I would also like to thank Paul Krueger, the environmental officer at De Beers Namaqualand Mine for access to the mine property.

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The Archaeology Department at the University of Cape Town was a tremendous place to work; it is a testament to good people working well together. I made many friends there who were willing and interested in drinking wine and arguing about archaeology: good times. In particular I want to thank Brian Stewart, Erin Finnegan, and Chopi Jerardino.

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Chapter One

Introduction

The purpose of this thesis is to develop a regional synthesis of archaeological evidence from the Namaqualand coastal desert of South Africa (Fig. 1.1). The focus of this study is to identify the choices that past people made in determining where to settle and what subsistence strategies were most effective in a desert environment. While the more temperate zones have been extensively studied, the southernmost aspect of the greater Namib Desert, has received little attention, primarily because the region is diamond rich and various mining companies, including the De Beers Namaqualand mine, restrict access. This has had a twofold effect, while open cast mining has no doubt had a negative effect on preservation of archaeological sites, the lack of urbanisation and strict access to the coast has preserved many thousands of open-air sites in pristine condition.

With growing debate around issues of the onset of behavioural modernity and the Middle Stone Age, it is important to understand as fully as possible the recent past, the Later Stone Age, in order to develop a full array of potential frameworks for comparison. In addition, while temperate regions, and areas of "plenty" have been heavily studied in southern Africa, it is also informative to understand how people adapted and modified their cultural perspectives in order to survive in more marginal environments, such as deserts.

Previous research conducted in Namaqualand includes the work of Jalmar and Ione Rudner (1953, 1968), who travelled through the region collecting information on pottery and ostrich eggshell decoration motifs. Lita Webley's Master's (1984) and PhD (1992) theses, focussed on the past 2000 years and the introduction of pastoralism into the region. Her research was of national importance as the earliest evidence for sheep was identified at Spoeg River Cave. In 1992, Jerardino *et al.* reported on a human burial that had been discovered through mining activities at the Groen River Mouth. Klein *et al.* (1999) reported on the excavation of a Middle Stone Age site at Boegoeberg, a little north of the area investigated in this thesis. Finally, Jayson Orton, Dave Halkett, and Tim Hart (2005) published the results from two open-air shell middens Rooiwaal Hollow and Rooiwaal Midden, near Spoeg River.

Figure 1.1 **Map showing the location of Namaqualand, South Africa. Image taken from Google Earth**

In 1991, the Archaeology Contracts Office, an affiliate of the University of Cape Town, conducted extensive surveys of the land owned by De Beers. They recorded the location of the sites as well as the surface material. As this project has been on going for fifteen years, there are now 1,349 sites on record, a vast database. Using this database, this project was developed: to look at choice of settlement location and subsistence strategies within the environmental context, through time and space. I began by plotting all the recorded sites using the geographical information system software package, Mapinfo 7.8 (Fig. 1.2).

Analysing the database provided immediate clues as to the time frame of human occupation of the region: Acheulian hand axes and quarry sites indicate an Early Stone Age presence on the coastal plain (between 0.5km and 1km from the coast: Fig. 1.3a). Middle Stone Age sites are more plentiful and are located on the coastal plain as well as the shoreline (<0.5km: Fig.

1.3b), although as sea levels have changed over time, there may well be many more sites under water. Finally, the majority of sites are from the Later Stone Age with 30% along the shoreline, 50% along the coastal plain and 20% inland (>1km from coast) (Fig. 1.4). Of particular interest is the distribution of sites in relation to surface water: one might expect to find open-sites in a desert region to be clustered around the rivers, but these are not, suggesting the use of alternative water sources such as springs. Coastal resources might also be expected to be the focus of occupation, but again, sites are not clustered around the rocky headlands teeming with shellfish. Thus, considerations other than accessing fresh water or shellfish must have had a greater influence on settlement choice, perhaps balanced access to marine and terrestrial species or protection from the southerly winds as there are no natural rock shelters on the Namaqualand coast, other than Spoegriver Cave.

Figure 1.2 **Distribution of all sites (red stars) identified by the Archaeology Contracts Office in Namaqualand, South Africa. The vast majority are from the Later Stone Age. Green hatching along the coast represents rocky headlands, while yellow represents sandy beaches**

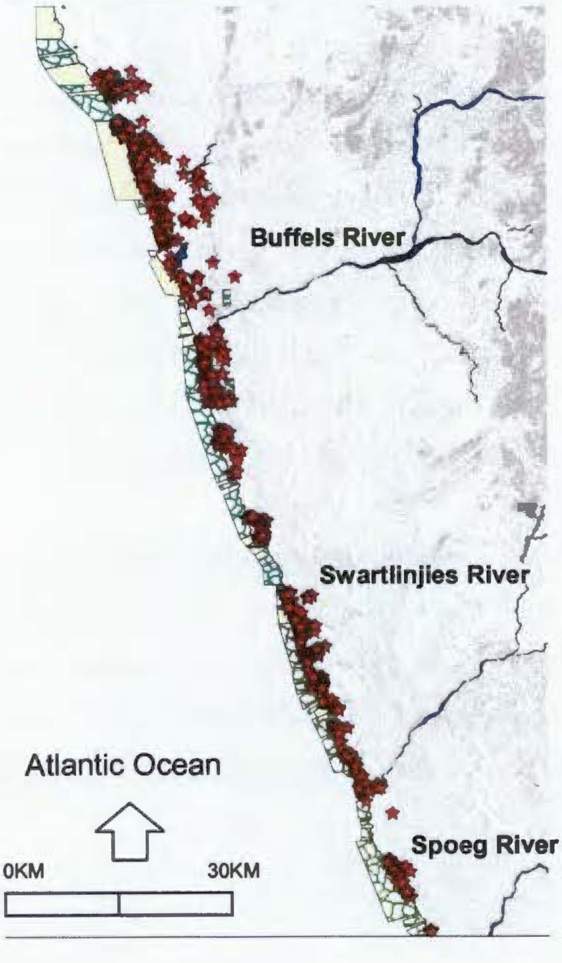


Figure 1.3 Maps showing the distribution of a) Early Stone Age sites, b) Middle Stone Age sites

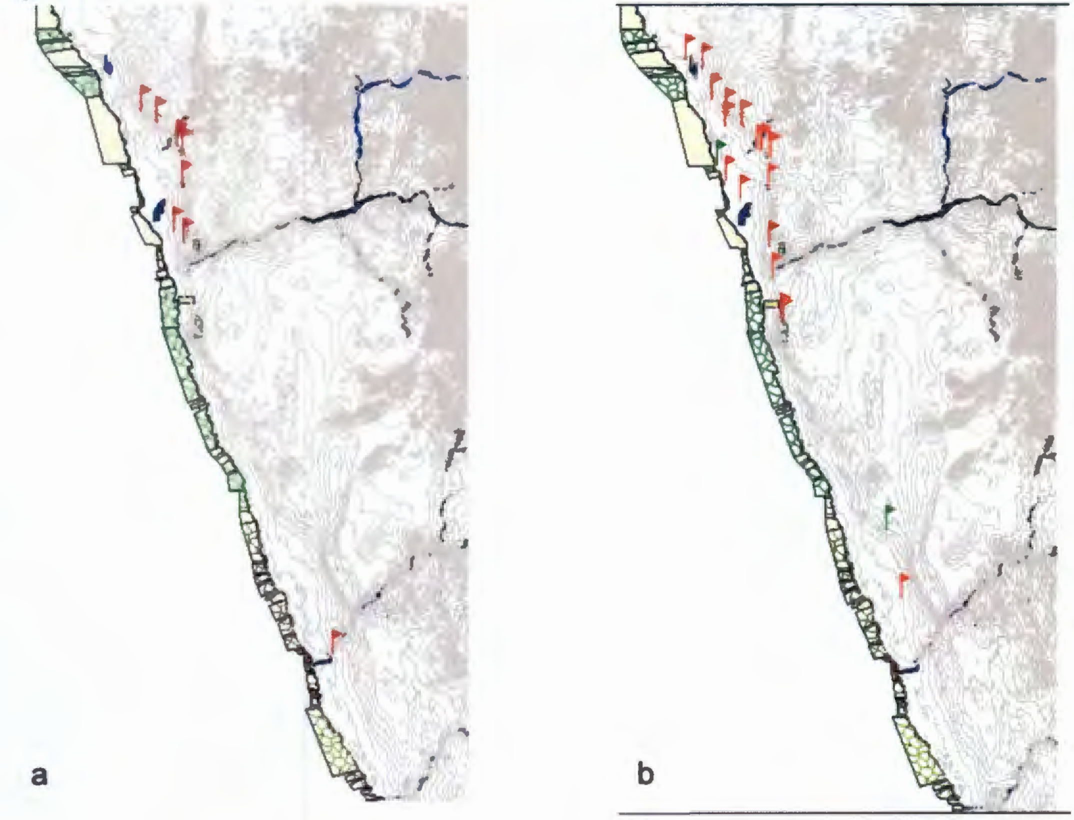
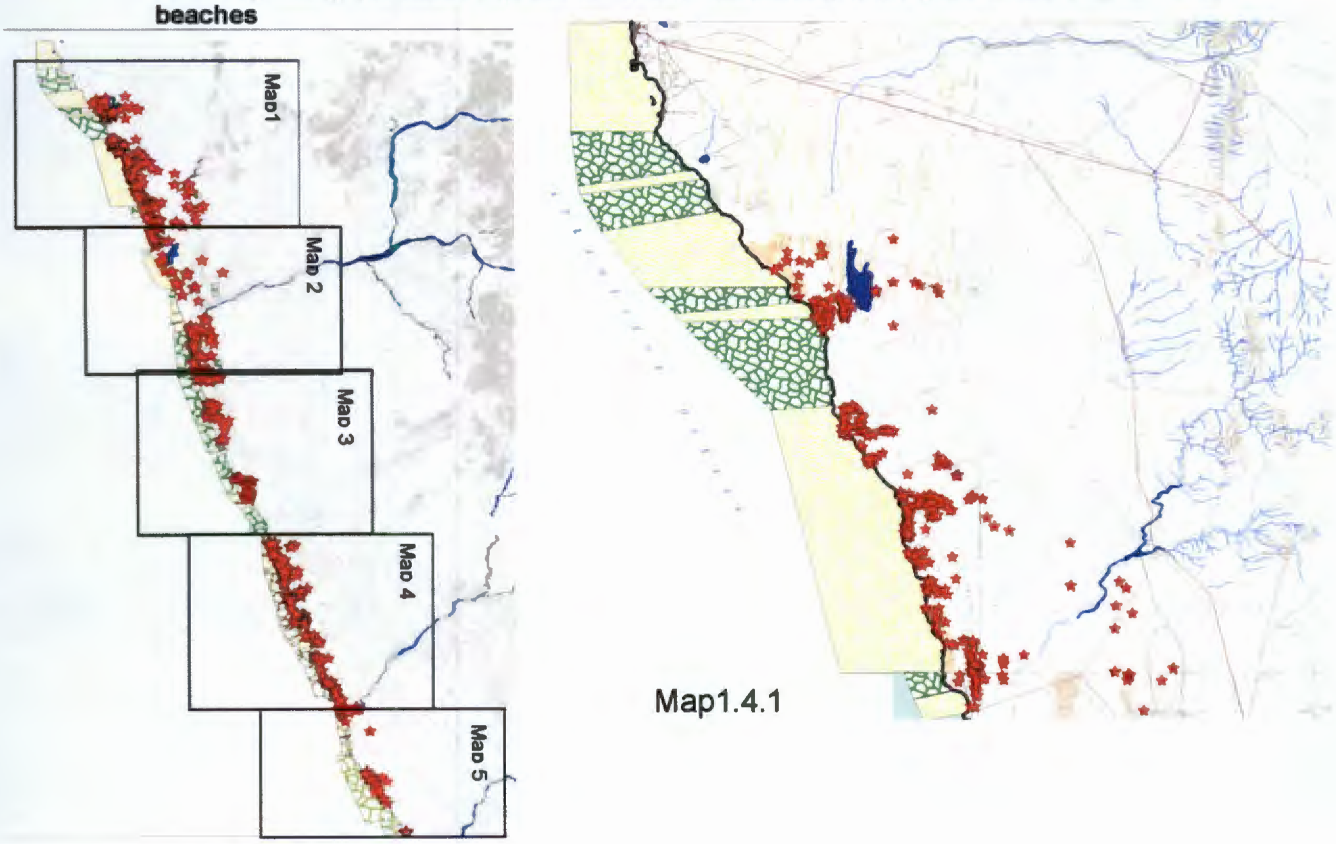
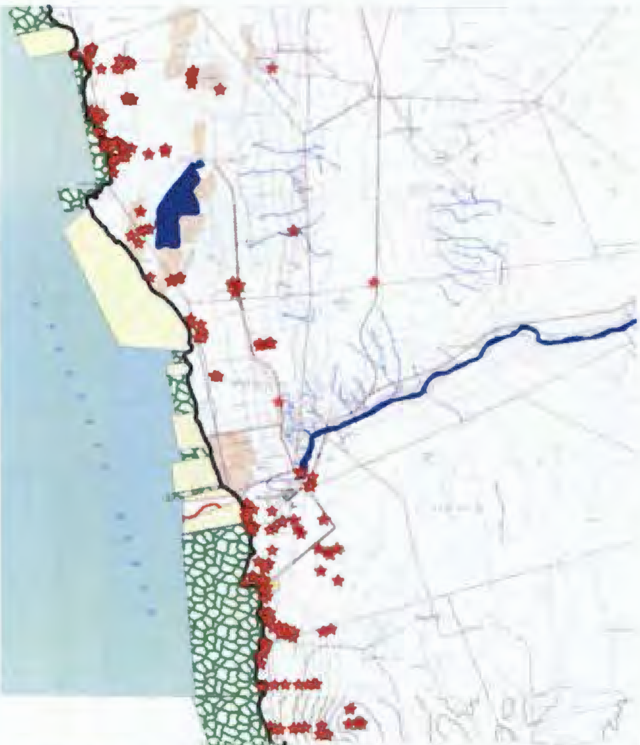


Figure 1.4 Distribution of Later Stone Age sites in Namaqualand (red stars). Green hatching along the coast represents rocky headlands, while yellow represents sandy beaches





Map 1.4.2

Map 1.4.4

Map 1.4.3

Map 1.4.5

In order to examine subsistence strategies, sites with particularly well-preserved bone were earmarked for full excavation. In the end, nine sites were chosen from across the study region (Fig. 1.5). While a few had already been excavated and awaited analysis, the rest required further expeditions over three years to excavate and recover the archaeological material. All material was analysed by myself with the exception of the lithics, which were analysed by my colleague Jayson Orton. Much of this thesis uses standard archaeological methods such as faunal analyses to study subsistence strategies, but it also incorporates the use of stable isotope analysis of human burials to further explore evidence for diet. The results from two approaches can then be compared with one another. The stable isotope analysis was conducted at the University of Cape Town.

In Chapter Two I discuss the current environment and location of the study area, followed by the evidence for changing palaeoenvironment through time.

Chapter Three outlines the archaeological background of southern Africa emphasising aspects relevant to this thesis, from the earliest evidence of *Homo erectus*, through the current debates of the Middle Stone Age and, especially what we know about the Later Stone Age. It considers the Later Stone Age in three broad time periods relating to changes in technology, environment, settlement systems, and subsistence strategies.

Chapter Four covers the methods used during excavation and analysis of the archaeological remains.

Chapters Five through Thirteen describe the excavation of the sites, and the results of the analysis of material recovered. These are full site reports, including the lithics, non-lithic artefacts, the faunal remains, shellfish data and estimates of relative contributions of kilojoules per species.

Chapter Fourteen discusses the stable carbon and nitrogen isotope analyses. This includes the nature of the local food chain, the stable isotope values of a small sample of faunal remains from the archaeological sites, and the results of the stable isotope analysis of the human burials, which are then evaluated in the light of local foods.

Chapter Fifteen draws the information in the preceding chapters together, to synthesis the sequence observed through the analysis of the nine sites. It also discusses how the stable isotope results from the previous chapter fit into the overall picture of subsistence strategies in Namaqualand. The discussion then focuses on how the Namaqualand data fits into the surrounding regional sequence, focussing on the Late Holocene and the introduction of pastoralism and pottery.

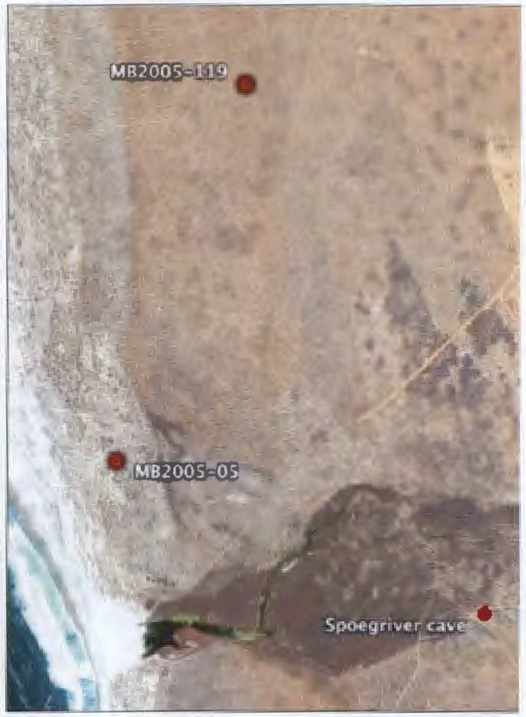
Chapter Sixteen is the conclusion and a summary of the main points of the thesis.

Figure 1.5 Maps showing the distribution of the archaeological sites analysed in this study. The top map shows the northern sites, while the bottom map shows the southern sites. Sites are shown in red, while burials are shown in blue. Note the cluster of burials at the Buffels River mouth at the town of Kleinsee. Images taken from Google Earth


KN6-3c


LK2004-011
langklip burial
LK5-1


Noup burial
uct 579+somnaas 2
KN6-3c
LK2004-011
LK5-1
langklip burial
Spoeg River
MB2005-119
Spoegriver cave
MB2005-05
0km
15km
Groenriver burial


MB2005-119
MB2005-05
Spoegriver cave

Chapter Two

Environment

As the southern African climate is fairly arid, the dominant factor that affects and defines environments is precipitation (Deacon & Lancaster 1988). In the east, precipitation is brought primarily by the Indian Ocean anticyclone during the austral summer months. The southwest receives rains influenced by the westerly winds or the South Atlantic anticyclone in the winter months (Chase 2005, Deacon & Lancaster 1988, Mitchell 2002). The region of intersection between these two rainfall regimes receives rain all year round (Fig. 2.1). In conjunction with the atmospheric circulation patterns, the main oceanic currents directly affect the climate: the Agulhas is a warm current off the south-east coast, while the Benguela is a cold current that runs parallel to the coastline, up the west coast (Fig. 2.1). In addition, the majority of the southern African landmass is a raised plateau surrounded by a narrow coastal plain. Thus, the climates and environments are determined by the relationships between these factors. The highest rainfall and richest concentrations of vegetation and fauna are found in the eastern, summer rainfall zone, with a second peak in the south-western Cape winter rainfall zone, while the driest, most arid region is the Namib Desert along the west coast (Deacon & Lancaster 1988). It is the most southerly extension of the Namib, known as Namaqualand, that is the focus of this study.

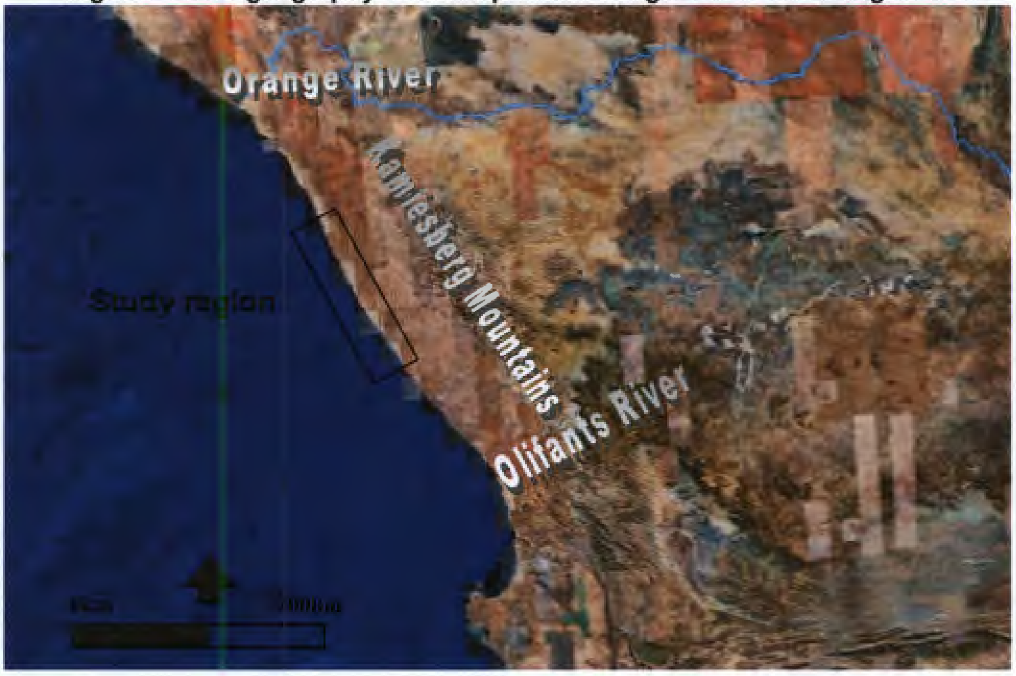
The coastal strip of Namaqualand runs from the Orange River (Gariep River) in the north to the Olifants River in the south, and is bounded by the Atlantic Ocean to the west and the Kamiesberg Mountains to the east (~100km inland) (Fig. 2.2). The region is within the winter rainfall zone (Fig. 2.1), with the granite Kamiesberg Mountains receiving the highest precipitation, averaging 170mm/annum. Drainage is westward into the Atlantic Ocean via perennial rivers, although today these rivers flow infrequently (on the scale of once a decade), unless there has been an uncharacteristic amount of rain such as was seen in 2006, when the rivers flowed three times in one year. The coastal strip consists of aeolian sand known as Sandveld, consisting primarily of recent Holocene white sand dunes on the coast and older Pleistocene red drift sands in the interior (Acocks 1979, Le Roux and Schelpe

1981). The coastline consists of many bays, old palaeoriver mouths and while some of these bays have sandy beaches, most of the coastline consists of rocky headlands and plateaus that teem with shellfish.

Figure 2.1 **Map of South Africa showing the rainfall zones and dominant currents. Note the edge of the continental plateau. SRZ is summer rainfall zone, WRZ is winter rainfall zone, YRZ is your-round rainfall zone. The blue zone on the west coast shows the region of cold water upwelling. Image taken from Google Earth**

The study area is 130km in length and 10km wide: from just north of the Buffels River to the Spoeg River in the south (Fig. 2.2). This region has an average annual rainfall of only 50mm to 20mm (south to north) with the paucity of precipitation due to the cold Benguela current and to upwelling of cold water from the bottom of the Atlantic Ocean, producing sea surface temperatures between 11°C and 17°C (Eitel 2005). When humid southerly winds pass over the cold Benguela current, the air is cooled and cannot hold as much precipitation. While rain is infrequent, when the humidity level is between 70% and 100%, coastal fogs can form bringing precipitation to the otherwise arid coastline. While the cold water upwelling of the Bengula stifles precipitation on land, it is nutrient rich and abundant with sea life. The average temperature on land is 15°C in the winter months and 20°C in the summer months, although it is not uncommon for temperatures to reach 35°C during the day in summer. The flora and fauna consist of arid adapted species that can survive dry conditions. Some animals obtain fresh drinking water through burrowing into dry riverbeds (Skead 1980).

Figure 2.2 The geography of Namaqualand. Image taken from Google Earth



The vegetation type is Strandveld, including many low succulents dominated by *Mesembryanthemacae* that stabilise the sand dunes. Riverbed communities are lined with bushes and trees including *Acacia karroo* and *Rhus viminalis* (Acocks 1979).

The majority of the fauna of archaeological interest in Namaqualand is small to medium mixed feeding ungulates adapted to dry open areas: grey duiker (*Sylvicapra grimmia*), springbok (*Antidorcas marsupialis*), and steenbok (*Raphicerus campestris*). Larger ungulates are rare but gemsbok (*Oryx gazella*), red hartebeest (*Alcelaphus buselaphus*), kudu (*Tragelaphus strepsiceros*) (in the Kamiesberg and along the Orange River), eland (*Taurotragus oryx*), black rhinoceros (*Diceros bicornis*), elephant (*Loxodonta africana*), quagga (*Equus quagga*) (extinct), hippopotamus (*Hippopotamus amphibius*), and giraffe (*Giraffa camelopardalis*) have been historically documented (Skead 1980), but are now regionally extinct. Other noncarnivorous species that continue to live in the region include the Cape hare (*Lepus capensis*), Namaqua dune mole rat (*Bathyergus janetta*), porcupine (*Hystrix africaeaustralis*), rock hyrax (*Procavia capensis*), and springhare (*Pedetes capensis*). Carnivores found in the region include Cape fur seal (*Arctocephalus pusillis),* lion (*Panthera leo*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), brown hyena (*Hyaena brunnea*), and wild dogs (*Lycaon pictus*), which are now regionally extinct, while the wildcat (*Felis libyca*), caracal (*Felis caracal*), yellow mongoose (*Cynictis penicillata*), meerkat (*Suricata suricatta*), genets (*Genetta tigrina* and *genneta*), Cape fox (*Vulpes chama*), bat-eared fox (*Otocyon megalotis*), black-backed jackal (*Canis mesomelas*), striped polecat (*Ictonyx striatus*), and honey badger (*Mellivora capensis*) currently live in Namaqualand. Other important species are the angulate and speckled padloper tortoises, *Chersina angulata* and *Homopus sugnatus,* crayfish (*Jasus lalandii*), shellfish, and many species of shorebirds including African penguin (*Spheniscus demersus*).

Of the non-indigenous domesticated species, sheep (*Ovis aries*), goat (*Capra hircus),* cattle (*Bos taurus*), and dog (*Canis familiaris*) are archaeologically important as sheep, goat, and cattle-herding constituted the only pre-colonial food production in the western parts of southern Africa. The exact timing and means of the arrival of these domesticates in South Africa has yet to be established, but there are sheep remains from c. 2000 years ago from Spoegriver Cave (Sealy & Yates 1994, Vogel *et al.* 1997, Webley 2002); some of the earliest in the subcontinent.

Today a large mainland seal colony (>350,000 individuals) is located on the coast 14km north of the Buffels River mouth. This is a breeding rookery, as opposed to a hauling out colony or a resting place. In fact, this is one of a few breeding rookeries left in southern Africa after commercial sealing vastly reduced the number of seals from the seventeenth century on. This makes identifying the location of past rookeries difficult. Through archaeological excavations, we can begin to identify the positions of past rookeries. In addition, most rookeries are located on offshore islands, such as Seal Island in False Bay, far from the influence of human predation.

In the past, there was a penguin hatchery on an island 0.5km off the coast of the current Buffels River seal rookery, Penguin Rock, but due to competition and predation with/by the seals, the penguins no longer breed there. The number of African penguin hatcheries has also been reduced through time, by human interference. If these or similar nurseries were established in the past, they would have been a rich, predictable resource for hunter-gatherers.

Palaeoenvironment

Studies of the palaeoenvironment of Namaqualand are few (Avery 1992, Chase 2005), and future research will hopefully address this paucity of data. The overview of the past environment of Namaqualand presented here will be bolstered by research conducted on the Namib Desert as a whole and by research further south along the west coast within the winter rainfall zone. The determination of palaeoenvironments is usually based on proxies for temperature or humidity with the most coherent results obtained from combined data from a wide range of disciplines including studies of pollen, aeolian, fluvial, and lacustrine deposits, gross size and presence of mammals including micromammals, ice cores, marine cores, stable isotope analysis, and archaeological deposits. With so many different lines of evidence, results do not always agree, but the use of palaeoclimatic indicators in interpreting past human behaviours is beneficial. I will thus summarise the current results of palaeoenvironmental research that apply to Namaqualand, focussing on the Holocene.

The minimum age of the coastal desert is late Miocene, with the establishment of the Benguela upwelling circulation seven to ten million years ago (Deacon & Lancaster 1988, Eitel 2005). Since its formation, the Namib coastal desert has varied through time from hyper-arid to semi-arid, but it has maintained its desert-like characteristics (Eitel 2005).

Cockcroft *et al.* (1987) and Tyson (1986) developed models incorporating modern weather patterns that propose that "the winter rainfall zone and summer rainfall zone react in a coeval inverse manner to cycles of global warming and cooling, with glacial periods enhancing the intensity of the winter rainfall zone systems and interglacial periods summer rainfall zone systems. The important implication of this is that during glacial periods those regions affected by winter rainfall zone systems will be relatively more humid, while those regions with a summer rainfall zone regime will experience relatively more arid conditions, and *vice versa*" (Chase 2005:56). These models are supported by studies of aeolian dune formation in Namaqualand during warm periods (Chase 2005) and pollen and charcoal research conducted in the south-western Cape by Parkington *et al.* (2000), which indicate the presence of afromontane taxa during the Last Glacial Maximum.

Thus, most researchers agree that the Last Glacial Maximum (dated to 18,000 to 20,000BP) was cool and wet with temperatures 5-6°C below today's values, and sea levels 120m below the current position (Baxter & Meadows 1999, Chase 2005, Meadows & Baxter 1999, Mitchell 2002, Scott *et al.* 2004). Other researchers, (Eitel 2005, Eitel *et al.* 2005), suggest that the Namib Desert was in fact dry during the last glacial period, with climatic indicators suggesting the region was strongly influenced by the climate of the summer rainfall zone. This is most likely due to the boundary between the rainfall zones fluctuating through time. While the central Namib Desert may have been more influenced by the summer easterly winds, the south-western Cape was entrenched within the winter rainfall zone and thus shows evidence for an increase in precipitation during the Last Glacial Maximum.

The Holocene is a less contentious period. Most research identifies the first half as a warm and dry period, culminating in the mid-Holocene altithermal some time between 8000-4000BP, with temperatures peaking at 2-3°C above present conditions (Chase 2005, Baxter & Meadows 1999, Deacon & Lancaster 1988). Evidence for an increase in aridity during this phase in Namaqualand is based on aeolian dune formation peaking between 8000-4500BP. Chase (2005) proposes that increased aridity and drought stress reduced vegetation cover and the strong southerly or berg wind systems re-activated the aeolian deposits. Also, pollen samples from Elands Bay in the south-western Cape (Meadows *et al.* 1996, Parkington *et al.* 2000) indicate increases in xeric taxa (Poaceae, Asteraceae, and Chenopodiaceae) from 7000-4000BP, in accordance with the Holocene altithermal. There is also a corresponding sea level transgression of 1-2m, which may have had a negative effect on the shellfish beds if they could not re-establish themselves further up the beach (Jerardino 1993, Meadows *et al.* 1996, Miller *et al.* 1993).

The second half of the Holocene is cooler and wetter overall with evidence for a 'neoglacial' period from 4000-2000BP, identified in the south-western Cape at Elands Bay based on the oxygen isotopes and aragonite-to-calcite ratio of limpets (Cohen *et al.* 1992), and pollen from Klaarfontein 18km inland from Elands Bay (Meadows and Baxter 2001), as well as Tortoise Cave. Similar trends are seen in South America (Jerardino 1995a) and Australia (Goede *et al.* 1996). In addition, other global patterns are recognised: evidence for the onset of the Medieval Warm Epoch (1050-650BP: warm and dry) is indicated as early as 1390BP in Namaqualand, based on the species list of micromammals from Spoegrivier (Avery 1992). The study ranges from 1920 to 1390BP and shows that the earlier phase has high species diversity and richness, as well as a relatively high number of species associated with grass biomes, indicating a cool and wet period. The later phase shows a decrease in species diversity and richness and the replacement of grass biome species by scrub species. Avery (1992) interprets this as an indication of a transition to a warm arid period, and the beginning of the Medieval Warm Epoch. Further evidence of a cool and wet period at 2000BP followed by a warm arid period is seen in Johnson's (1988) study of the foraminiferal data from marine cores off Walvis Bay (Namibia) (in Tyson & Lindesay 1992) and the Cold Air Cave stalagmite (Stevenson *et al.* 1999, Tyson *et al.* 2000). There is also evidence for the Little Ice Age (650-150BP: cool and wet) from the foraminiferal data from Walvis Bay, and from the study of the oxygen isotopes and aragonite-to-calcite ratio of limpets from Elands Bay (Cohen *et al.* 1992) and the Cold Air Cave stalagmite (Stevenson *et al.* 1999, Tyson *et al.* 2000).

While the study area falls within the winter rainfall zone, the rest of southern Africa is influenced by summer rainfall climate variations and experienced conditions directly opposite to the winter rainfall zone: the Little Ice Age was a cool and arid time in the summer rainfall zone.

Table 2.1. Simplified schematic of estimated palaeoclimate of Namaqualand during the Holocene

7000BP	mid-Holocene aridity	Warm	Arid
4200BP-2000BP	Neoglacial	Cool	Wet
2000-1390BP	continued cool	Cool	Wet
(1390-1050)-650BP	Medieval Warm Epoch	Warm	Arid
650-150BP	Little Ice Age	Cool	Wet

Chapter Three

Background

Figure 3.1 **Archaeological sites discussed in the thesis. Image taken from Google Earth**

Evidence for widespread human occupation of southern Africa (other than the few Oldowan tools at Sterkfontein Cave and developed Oldowan tools at Swartkrans) dates back to the Early Stone Age with Acheulian bifacial handaxes, made by *Homo erectus*. These artefacts are usually found in dynamic environmental contexts such as river valleys and wetlands, making direct dating difficult as the artefacts and associated materials are not necessarily in primary context. In general however, the Acheulian industry ranged from 1.4 million to the middle Pleistocene 250,000 years ago (Deacon & Deacon 1999).

Fossil evidence for early archaic *Homo sapiens* includes a skull cap found at Elandsfontein in the south-western Cape and the Kabwe specimens (originally called *Homo rhodesiensis*) from Zambia, which date to the middle Pleistocene 600,000 to 300,000 years ago. Late archaic *Homo sapiens* fossils include specimens from Cave of Hearths and the Florisbad skull, which is likely to be c. 260,000 years old (Grün *et al.* 1996). Finally, early evidence of anatomically modern *Homo sapiens* in South Africa consists of specimens and archaeological material from Klasies River mouth, Border Cave, Die

Kelders Cave, Blombos Cave, and Equus Cave. These fossil remains are thought to be 120,000 years old and younger, when the Middle Stone Age record is particularly rich in South Africa. The Middle Stone Age industries (most often characterised by large points, large standardised blades, prepared cores etc.) are represented at many sites throughout southern Africa, both inland and on the coast. Two industries, Still Bay (bifacial points) and Howieson's Poort (large segments) are highly patterned phases within the Middle Stone Age, and the presence of these artefacts are excellent relative dating indicators: Still Bay dates to c. 75,000 years ago (Jacobs *et al.* 2006, Tribolo *et al.* 2006) and Howieson's Poort c. 70,000 to 60,000 years ago (Mitchell 2002). At the moment, research into the Middle Stone Age of southern Africa is focussed on the debate regarding the timing of the emergence of behaviourally modern *Homo sapiens* (Klein 1999, 2000, McBrearty & Brooks 2000). Richard Klein has argued that behavioural modernity began c. 40,000 years ago, perhaps as a result of a genetic mutation in the brain that enhanced cognitive abilities (Klein 1989b, 1999, 2000). On the other hand, evidence from Blombos Cave indicates that engraved ochre, finely made bone points, and seashell beads were manufactured 77,000 years ago, arguably evidence for art and symbolic behaviour: typically modern traits (d'Errico *et al.* 2005, Henshilwood *et al.* 2002).

Middle Stone Age people utilised a greater range of landscapes and choice of site locations reflects this: lowlands, highlands, interior, and coastal sites. Not only did they occupy riverine environments, archaic *Homo sapiens* expanded and more commonly utilised coastal resources such as shellfish, seals, and shorebirds, although this is not to say that marine resources were not being exploited prior to the Middle Stone Age (cf. Erlandson 2001). In addition to the greater input of marine resources, we have more evidence for the use of plants, such as tree fruits like marula (*Sclerocarya birrea*) and geophytes (underground corms, tubers) requiring farming with fire (Deacon HJ. 1993), and there is evidence for hunting bovids of all sizes. Klein and Cruz-Uribe (1996) suggest that people focussed on the more docile bovid species such as eland (*Taurotragus oryx)* and the very young and old of aggressive species such as the extinct giant buffalo (*Pelorovis antiquus*), and probably scavenged the Cape fur seals (*Arctocephalus pusillis*). Evidence for human occupation in Namaqualand during the Middle Stone Age is present at the shelter site Boegoeberg 2, although it has yet to be fully described, but Boegoeberg 1, a hyena den, has been radiocarbon dated to be greater than 37,000BP (Klein *et al.* 1999)

The end of the Middle Stone Age is dated at Boomplaas in the southern Cape to between 32,000 and 21,000 years ago, while the Apollo 11 Cave site in Namibia narrows the range to between 27,000 and 20,000 years ago. Most researchers agree that the identification of unquestionable Later Stone Age industries over large areas in southern Africa is c. 20,000 years ago, at about the same time as the Last Glacial Maximum (Deacon & Deacon 1999).

The Later Stone Age of southern Africa is characterised by innovations: rock art, bows and arrows, fishing tools, intentional burial of the dead, bored stones as digging-stick weights, proliferation of bone tools, decorative objects such as ostrich eggshell beads and pendants, more frequent use of microlithic tools, and the eventual introduction of pottery and pastoralism. There is also evidence for an increase in population sizes compared to the Middle Stone Age, indicated by the reduction in the size of species such as limpets and tortoises due to over harvesting (Halkett *et al.* 2003, Klein 1991, 1992, 2000).

The Later Stone Age is broken up into four broad time periods based on the size of the lithics: Late Pleistocene microlithic (20,000-12,000BP), early Holocene macrolithic (12,000-8,000BP), and the two Holocene microlithic periods (8,000-4500) and (4500-100BP). However, a note of caution is required: while there are gross changes in the lithic assemblages that correspond with these time periods, there is no evidence for rapid changes and there is great regional variation in the expression of lithic industries. It is necessary to recognize the importance of place and the set of opportunities that each place presents, as well as changes through time (Parkington 1980). In other words, Parkington argues that differences in lithic assemblages may be related to what resources were available at a particular place at a particular time, rather than signalling different groups of people.

Late Pleistocene microlithic assemblages (20,000-12,000BP)

The late Pleistocene microlithic period includes the Last Glacial Maximum and subsequent global warming. Assemblages include many microlithic bladelets made on bladelet cores, with some bladelets exhibiting backing. In addition there are small scrapers but the overall pattern is non-formal, with artefacts usually made on quartz (Deacon HJ. 1976, Deacon J. 1972, 1984b). Non-lithic artefacts from this time include polished bone points, bone and ostrich eggshell beads, tortoise bowls and containers, the use of ochre and decorated ostrich eggshell flasks (Deacon & Deacon 1999). There are several sites across southern Africa with occupation layers from this time period (Mitchell 1995, Wadley 1996), with Nelson Bay Cave on the south coast (Klein 1974, 1978b), and Boomplaas Cave in the interior (Deacon HJ. 1976, Deacon J. 1984b), having particularly good examples. Variations of microlithic early Later Stone Age industries have been identified from Zimbabwe, Zambia, Namibia, Kenya, Somalia, Morocco, as well as India, Australia, and Europe (Deacon & Deacon 1999).

During the Last Glacial Maximum, the sea level in southern Africa was 120m lower than present, exposing the continental shelf that became vast grasslands. During this time the dominant species in archaeological assemblages were grazers, and included prime adults of very large species, such as giant buffalo, giant horse, and giant hartebeest (Klein 1972, 1978a). It is often assumed that the larger species would have required many hunters working together not only to kill the animals but also to help process and eat them. Thus, social groups were probably large, and followed the migrating animals. These large species eventually became extinct around 10,000BP, with many other 'mega' species across the world. Their demise is usually attributed to over hunting and/or climate change, as the world grew warmer, with the rise in sea level drowning the continental shelf grasslands.

Early Holocene macrolithic assemblages (12,000-8,000BP)

From roughly 12,000BP, at sites south of and including southern Zimbabwe, the lithics consist of large scrapers with few formal tools, while sites in northern Zimbabwe and Zambia maintained a microlithic industry (Mitchell

2002, Orton 2006). Evidence increases for the use bone points and ostrich eggshell beads, artefacts ethnographically associated with trade and risk sharing systems (cf. Wiessner 1982). While the exact timing of the development of the bow and arrow is unclear, Mitchell (1988) and Wadley (1998) emphasise their increased numbers between 12,000 to 10,000BP, while Parkington (1998) suggests a date of 9000BP. The onset of the use of bow and arrows may suggest a change in gender roles, excluding women from hunting, with men no longer requiring the assistance of women to hunt and process very large animals (Wadley 1998). There is also evidence for long distance trade in the south east, with marine shells found at interior sites and ostrich eggshell at coastal sites (Mitchell 1996).

With the extinction of the very large animals at 10,000BP, there is a greater reliance on smaller meat packages that occur in smaller numbers and reproduce rapidly, such as shellfish, crayfish, fish, seabirds, ostrich eggs, tortoises, rodents, and even newborn small bovids (Mitchell 2002, Parkington 1988), although large game animals are still hunted. There is also greater evidence for the use of a variety of plants including fruits, nuts, and geophytes. In addition, the frequency of browsing animals in archaeological assemblages are on par with grazing animals (Klein 1972, 1978b), suggesting a decrease in grasslands and an increase in bush and trees, especially along the southern and south-western Cape coasts.

Holocene microlithic assemblages: 8,000-4,500BP

From 8000BP, a new microlithic tool-making tradition spread southwards through Zimbabwe, Namibia, and then South Africa (Deacon J. 1984b). Assemblages contain a wide variety of small scrapers and backed artefacts. Formal tools are present in higher frequencies in these assemblages than in earlier or later ones, and the tools themselves are more standardized. Raw materials include a higher proportion of fine-grained rocks (Deacon J. 1972, 1984b). Non-lithic artefacts include a greater variety of bone and wood tools, as well as shell artefacts and an increase in the use of ornamentation such as ostrich eggshell and bone beads as well as pendants. This is the warmest period of the Holocene with increased rainfall in the summer rainfall zone and increased aridity in the winter rainfall zone. People more or less abandoned the arid interior of the sub-continent although regions with high rainfall and greater productivity, the Ghaap escarpment, the south and eastern Cape coasts continued to be occupied (Deacon J. 1974, Humphreys & Thackeray 1983, Wadley 1997, 2000). This is a time of intensification with increasing populations; people were less mobile using more local foods. There is even more reliance on small meat packages of non-migratory species that are easily snared or trapped. Small ground dwelling species such as rodents and tortoises increase in importance as do smaller bovids. By shortly before 4000BP, browsing species dominate over grazing animals, in the southern Cape, indicating that a forest biome has replaced the grasslands, probably due to the increased rainfall and temperature (Klein 1972, 1978b). From 5000 to 4000BP, at Welgeluk on the Fish River in the Eastern Cape, people started to use exotic silcrete as a socio-spatial stylistic marker of a homogenous cultural region. Eventually the subsistence strategy shifted to aseasonal food items and the use of storage pits. These factors indicate that territorial regions were shrinking, reducing mobility (Hall 1990). Another region that has evidence for human occupation during this warm period is the Ghaap escarpment in the Northern Cape. Both Wonderwerk Cave and Little Witkrans shelter have occupations dated to the mid-Holocene. Wonderwerk Cave layers 4a-c are dated to 7430±60BP (Pta-2798), 5930±50BP (Pta-2140), 5180±70BP (Pta-2544), 4890±70BP (Pta-2797); while Little Witkrans has two mid-Holocene dates 7470±70BP (Pta-2490) and 4710±65BP (Pta-2448) (Humphreys & Thackeray 1983). Backed blades and segments dominate the early assemblages from these two sites, made on local fine grained materials, hornfels and cherts, and banded ironstone at Wonderwerk Cave. At 4710BP at Little Witkrans and 4000BP at Wonderwerk Cave, the frequency of bone points increases and end scrapers dominate the lithic assemblages until the sites are abandoned in the second millennium AD. Decorated ostrich eggshell is present throughout both assemblages and consist of a range of motifs, including crosshatching, parallel lines, single lines, chevrons, and checker boards (Humphreys & Thackeray 1983). Palaeoenvironmental reconstructions based on the abundance of micromammals from Wonderwerk Cave (Avery 1981), indicate that from 9000 to 5000BP the region was wetter than today, allowing bushes and trees to encroach on the Cave. The climate shifted at 5000BP to become drier, with less grass and more shrubs. As the region is within the summer rainfall zone, this is to be expected following the climate models used in this thesis (Chapter 2: Table 2.1). The site of Dikbosch 1, on the other hand, also from the Ghaap escarpment, but farther south than Wonderwerk or Little Witkrans, was abandoned during the mid-Holocene and was not re-occupied until 1720±40 (Pta-3413), perhaps indicating a boundary of the are of mid-Holocene occupation. The data from the Ghaap escarpment sites supports the theory that people moved out of the arid zones into regions with increased rainfall including the southern and eastern Capes, during the warm mid-Holocene.

Holocene microlithic assemblages: 4500-100BP

By 4200BP, the climate was cooling with the onset of a neoglacial period, increasing rain in the winter rainfall zone. After 4000BP, increased population (as seen in the increase in the number of sites) and increased competition for local resources caused repopulation of the areas that were abandoned during the mid-Holocene (Deacon J. 1974). In addition, there is more intensive use of local resources from immediate surroundings, such as dassie/rock hyrax (*Procavia capensis)*, shellfish, and Cape fur seals at coastal cave sites (Mitchell 2002). At Nelson Bay Cave in the southern Cape, stable isotopic analyses of skeletons indicate dietary differentiation among groups of people buried at sites only 14km from one another. This has been interpreted as evidence for territoriality, at a time of high population density (Sealy 2006). In the south-west Cape, Elands Bay Cave and Tortoise Cave were re-occupied (Jerardino 1993, 1995b, Parkington 1988), and there has been ongoing debate regarding whether or not people were practicing seasonal transhumance at this time, between the interior and the coast (Parkington 1988, 1991, 2001, Sealy & van der Merwe 1986, 1992). From 3000-2000BP, at the onset of the cooling of the second half of the Holocene and a wetter period in the winter rainfall zone, people in the Elands Bay area abandoned large cave sites and created large (up to 1000m^3) open-air middens or 'megamiddens', consisting primarily of black mussels (*Choromytilus* *meridionalis*), a low ranked food item that reproduces rapidly. An increased number of burials and the large size of the sites suggest an increase in population. Stable isotope analysis of bone from burials dated to this period indicates a strongly marine diet (Sealy & van der Merwe 1988). If people were drying out the meat from the mussels and storing it, as suggested by Henshilwood *et al.* (1994), then they were beginning the transition from an immediate-return to a delayed-return subsistence strategy (Woodburn 1982), also identified on the Fish River (Hall 1990, Jerardino & Yates 1997). Thus, it appears that, with an increase in population, people had to rely on lower ranked food items as they were becoming more sedentary.

The lithic assemblages from the first half of this period are for the most part similar to the previous period, with formal tools made on fine-grained materials. Thereafter, around 2000BP in most places, there is an overall reduction in the presence of formal tools and quartz dominates lithic assemblages to the detriment of the fine-grained materials. Close to the study region, the lithic assemblages of open-air and cave sites in the Elands Bay region from 4370±60BP (Pta-5313) to 320±50BP (Pta-1815) (Parkington in prep), are dominated by quartz followed by silcrete (Orton 2006), with formal tools made on both materials until 1000BP, when silcrete all but disappears from the assemblages and formal tools become less frequent (Orton 2006). Throughout this time period side scrapers are more numerous than backed tools. One exception is the large open-air site of Dunefield Midden 1 (1190±40BP Pta-5405, marine corrected to 650BP, Tonner 2005), which is strongly dominated by backed bladelets made on quartz crystal (Orton 2002, 2006).

At Rooiwal Hollow (2505±20BP Pta-8915 with a marine corrected date of 2060BP / 2360±60BP Pta-8909 marine corrected to 1895BP) and Rooiwal Midden (1110±50BP Pta-8910 marine corrected to 580BP), both open-air sites on the coast of Namaqualand, the lithic assemblages are strongly dominated by quartz crystal, with a backed bladelet industry (Orton *et al.* 2005), and while there is a small component of cryptocrystalline silica (CCS) at Rooiwal Hollow, it is gone by the occupation of Rooiwal Midden. In addition, ostrich eggshell beads are small, ranging in size from 3.3 to 4.2mm at Rooiwal Hollow, while they get larger at Rooiwal Midden, ranging from 4.4 to

8.0mm. The Spoeg River cave assemblage is dominated by quartz (~80%) throughout, while in layers 12 (3580±60BP Pta-6987) and 13 (3520±50BP Pta-6754), CCS ranges from 10.8% to 12%, with scrapers more numerous than backed artefacts (Webley 2002). From layer 11 (layer 10 is dated to 2400±25BP Pta-7200) until the abandonment of the cave, the frequency of CCS drops, and backed tools dominate. The ostrich eggshell beads are small, averaging 4.3mm in layers 12 and 13, becoming larger in layer 6b (1930±50BP Pta-6749) and increasing in size through time: from 4.9 to 7.8mm through time. Decoration on ostrich eggshell consists of a crosshatching motif from the early layers until layer 6b when this artefact type is no longer present (Webley 2002). Decorated pottery appears in layer 3 (1450±50BP Pta-6750) and shows horizontal incised lines below the lip (Webley 2002). Northeast of Namaqualand, in the Richtersveld, at the shelter of Die Toon (3840±60BP, Pta-5960: 3110±60BP Pta-5963), the lithic assemblage is dominated by quartz (80%) followed by hornfels (Webley *et al.* 1993). The formal tools are all backed (backed pieces and a few segments). The mean diameters of ostrich eggshell beads ranges from 3.0mm to 4.2mm (Webley *et al.* 1993), and while decorated ostrich eggshell is reported, the motif is not. Also in the Richtersveld, the stone artefacts assemblage from the shelter of /Ai Tomas is dominated by quartz followed by silcrete, although some scrapers are also made on chalcedony (Webley 1992). Area 3 at /Ai Tomas (1980±120BP Pta-5530) is dominated by scrapers, but by the occupation of Area 1 (420±50BP Pta-5458) the few formal tools are dominated by backed tools (Webley 1992). The mean sizes of ostrich eggshell beads range from 4.2mm through to 5.4mm. Decorated ostrich eggshell is concentrated in Area 3 and shows crosshatching and parallel lined motifs. There are 50 sherds of pottery from Area 1 and 423 sherds from Area 3. These conform to Rudner's (1968) classification of Cape coastal ware, with lugs and decoration consisting of a single row of circular impressions or horizontal and/or diagonal lines beneath the lip.

At the Orange River, the open-air sites Jakkalsberg L and N are both dominated by quartz followed by CCS (Orton 2007). At Jakkalsberg N (4500±50BP Pta-8496) numbers of side and backed scrapers are nearly equal to those of backed tools, including rare denticulates (Orton 2007, Orton

& Halkett 2001), while at Jakkalsberg L, (3330±70BP Gx-32065) backed artefacts, including rare triangles, dominate over side and backed scrapers. The ostrich eggshell beads are variable, ranging from 2.8 to 6.5mm at Jakkalsberg N and 2.5 to 6.5mm at Jakkalsberg L. The decorated ostrich eggshell motifs are parallel lines and crosshatching, common in the Northern and Western Cape (cf. Rudner 1953) and there is a single undecorated ostrich eggshell pendant (Orton 2007). Jakkalsberg A and B, (A: 1300±25BP Pta-6100; B: 1380±50BP Pta-6101), are dominated by quartz, but there are only five formal tools (four are segments) at Jakkalsberg A and none at Jakkalsberg B (Webley 1997). The ostrich eggshell beads at Jakkalsberg A range from 2.6 to 10mm while at Jakkalsberg B the mean size is 5.7mm (Webley 1997). Decorated ostrich eggshell was identified at both sites, with a motif of single lines. Pottery is also present (n=1065 sherds at A and n=505 sherds at B) with lugs at Jakkalsberg A and spouted pots at Jakkalsberg B, while the decoration consists of horizontal and or diagonal incised lines and impressed dots. The small faunal sample is dominated by sheep (Webley 1997). At the site of Bloeddrift 23 (355±15BP Pta-7942), the stone assemblage is dominated by quartz and has only one formal tool, a backed bladelet made on quartz crystal (Smith *et al.* 2001). The ostrich eggshell beads are large with a mean size of 7.6±1.6mm. Decoration is identified on seven of the 609 sherds of pottery, with punctate incisions below the lip, while lugs and a nipple base were also present. There is also one bone from a goat (*Capra hircus*) and three from equids (two donkeys and one horse). To the east along the Orange River, Beaumont *et al.* (1995) have identified an industry Beaumont calls the Springbokoog. The lithic assemblages consist of a high frequency of CCS and 80% of the formal tools are backed blades. These sites have two clusters of occupation, from 4500-4300BP and 2600-2300BP (Beaumont *et al.* 1995). With the introduction of ceramics, Beaumont concludes that there are two lithic industries: the Swartkop industry clustering from 500-200BP, consists of acircular blades, backed blades, coarse undecorated pottery with grass temper, and iron objects. The Doornfontein industry (Beaumont *et al.* 1995, Beaumont & Boshier 1974), also identified at Blouberg (Parsons 2004), ranges from 2000 to 120BP, and consists of an informal quartz tool industry, with few, if any formal tools, thin-walled coarse pottery with grass temper and a higher component of iron and copper goods. These industries are confined to the region surrounding the Middle Orange River (Beaumont *et al.* 1995). Further to the northeast, in layer 3b (2910±60 Pta-2543) at Wonderwork Cave the dominant raw material is chert followed by banded ironstone, although backed artefacts were predominantly made on chert and quartz (Humphreys & Thackeray 1983). End scrapers continue to dominate. There are two undecorated pendants. In the post 2000BP layers 3a (1890±50 Pta-2542) and 2 (1210±50BP Pta-2779), the dominant raw material fluctuates between chert and banded ironstone, with end scrapers continuing to dominate (Humphreys & Thackeray 1983), and while sheep and goat are identified in the upper layers, they do not dominate the faunal assemblage. In total there are only five undecorated pottery sherds at Wonderwerk Cave. Little Witkrans has an occupation layer dated to 1490±40BP (Pta-2447), with chert end scrapers continuing to dominate the assemblage. There is very little pottery and no decoration (Humphreys & Thackeray 1983). Sites in the southern Namib Desert, including the cave site of Apollo 11, lack evidence of occupation from the mid-Holocene through to the second millennium AD (Kinahan & Kinahan 2006, Wendt 1972). Skorpion Cave in southern Namibia (1340±60BP Beta-160049: 180±50BP Beta-160048) is dominated by quartz (both vein and crystal) followed by CCS (Kinahan & Kinahan 2003). There are only seven formal tools, with side and end scrapers (on CCS) dominating over a single quartz crystal segment. There are 86 pottery sherds and lugs, but no decoration no evidence for domesticated sheep (Kinahan & Kinahan 2003). At Apollo 11, the occupation layer from this period is dated at 250±45BP (KN-608) with CCS dominating the lithic assemblage, followed by quartz and no formal tools, only medium to large flakes (Wendt 1972). The pottery sherds are undecorated and there is no evidence for sheep (Wendt 1972).

Thus, while most sites are dominated by quartz, the sites along the Orange River clearly have access to a wider range of fine-grained materials. With the re-occupation of sites after the mid-Holocene, side scrapers dominate most formal tool assemblages, except for the Ghaap escarpment sites where end scrapers are more common. Over the last 2000 years, backed tools become more common until formal tools dwindle in frequency and medium size quartz flakes like those identified in the Doornfontein industry of the Middle Orange River, become more abundant.

Clearly, by 2000BP, pastoralism and pottery were introduced to southern Africa, but it is not yet clear if they arrived as a package, or whether the mode of introduction was through migration of a pastoralist society or diffusion of a new way of life among former hunter-gatherers (but see Smith & Ouzman 2004 on a discussion of rock art). Based on direct radiocarbon dates on sheep, it seems most likely that pottery pre-dates the arrival of significant numbers of sheep (Sealy & Yates 1994). Sheep (*Ovis aries*) arrive before goats (*Capra hircus*) or cattle (*Bos taurus*), with the earliest AMS radiocarbon dated sheep bones coming from Spoeg River Cave in Namaqualand at 2105±65BP (OxA-3862) and Blombos Cave on the southern Cape coast at 1960±50BP (OxA-4543) (Henshilwood 1996, Sealy & Yates 1994, Webley 2002). It seems that, based on the radiocarbon dates, sheep were at the southernmost part of Africa only a few decades after they entered the country. Stowe (1905), Cooke (1965), and Elphick (1977) proposed that Namaqualand was one of two north to south routes into South Africa, the other being down through the middle of the country. With the identification of the earliest sheep bone at Spoegrivier Cave, it seemed likely that the west coast was indeed the route taken. This was made more relevant as intensive work by Garth Sampson and his team in the Seacow River Valley, at sites such as Abbots Cave and Blydefontein Cave, has been unsuccessful in locating evidence of early pastoralists in the interior (Sampson 1972, Sampson *et al.* 1989, Sampson & Plug 1993). Smith *et al.* (1991) have attempted to isolate hunter-gatherer versus pastoralist signatures. They see the increasing size of ostrich eggshell beads, the reduction in formal tools, the presence of pottery and domesticates as indicative of a new group, the herders. Concurrently, sites with small beads, formal tools, little or no pottery, and wild fauna are seen as hunter sites. Finding herder sites has, however, been difficult and most post 2000BP sites have a few pieces of pottery, a few formal tools, and no sheep. In fact, on the west coast of South Africa, only the Kasteelberg group of sites, on the Vredenburg peninsula, south-western Cape, have vast numbers of sheep remains and large amounts of pottery, one of which Sadr (2004) has interpreted as a ritualistic feasting site. Debate has centred on the extent to which, the difference between hunter-gatherers and herders is cultural or economic: did herders who lost their sheep become hunter-gatherers, and hunter-gatherers who obtained stock become herders (cf. Elphick 1977, Sadr 2003, Schrire 1980). One of the main issues regarding the adoption of a herding lifestyle is the concept of ownership. Hunter-gatherers using an immediate returns strategy and system of risk sharing will have difficulty making the transition to a society of herd ownership. However, there is regional evidence for a reduction in mobility and the transition to a delayed-returns strategy (the use of storage) before the arrival of pastoralists, perhaps making people more willing to adopt the more complex behaviour of ownership (Sadr 1998).

As pottery is used to identify herders, the large assemblage at Kasteelberg has been extensively studied, and a sequence of the changing motifs and forms described. Thus, the earliest pots are undecorated but are fine-grained and well fired, while the second half of the first millennium AD yields narrow necked, spouted pots with impressed and incised decorations (Sadr 2003). Second millennium pots include larger undecorated jars with pierced lugs for suspending the vessel (Sadr 2003). A third change in pottery style occurs in the second half of the second millennium with pierced lugs and incised lines around the neck. Vessels of this type were used in historic times by Nama pastoralists in Namaqualand (Sadr 2003).

About 1600BP, Bantu agro-pastoralists migrated into South Africa, bringing with them the innovation of iron working. They populated the summer rainfall zone in order to grow their crops of millet and sorghum. They traded and influenced peoples they shared borders with. In 1652AD, the Dutch East India Company established a permanent base at Table Bay in Cape Town to provide fresh produce, including meat, for ships sailing between Europe and Asia. This marked the beginning of a new, more intensive phase of interaction in the long-term relationship between Europeans interested in obtaining fresh meat and the local Khoekhoe pastoralists.

Chapter Four

Methods

Nine archaeological sites were chosen for analysis, as they exhibited evidence for good organic preservation, especially of bone. All are open-air shell middens, with no clear evidence for palimpsests or overlapping of occupations. Marine shell is the most visible and abundant component of the sites, and it is the distribution of shell that usually delimits the extent of the sites. Through experience in excavating sites in the region, it was noticed that most other categories of archaeological material such as bone and artefacts, tended to be located within the densest concentrations of shell. Thus, wire rods were used to identify the densest concentrations of material beneath the surface scatter of shell, and that is where excavation would begin.

Excavation

All sites were excavated using standard methods. A grid was demarcated with large measuring tapes and using either 1m^2 or 0.25m^2 units. All sites were excavated stratigraphically. Tools included spades for the removal of overburden, trowels and pans, 10L buckets, a 3mm and a 1.5mm sieve. All material was carefully packaged and returned to the University of Cape Town for cleaning, analysis, and storage. Only shellfish was sub-sampled due to the large volume of material that would otherwise have had to be transported and stored. The densest squares were chosen to obtain a shellfish sub-sample, as they would most likely be representative of species within the midden. The volumes of the shell middens were recorded through the counting of buckets of deposit removed, with shellfish counted separately, although this method was utilised only in the second half of the project, and unfortunately, the volume is not known for all sites. On site drawings were made of the location of in situ areas of deposit within the middens.

Radiocarbon dating

Two laboratories were used for radiocarbon dating the material: the QUADRU lab at the CSIR in Pretoria, and Geochron lab in Cambridge, Mass. As the material used for radiocarbon dating was from the southern hemisphere, the

Southern Hemisphere calibration program SH93CAL was used (Pretoria radiocarbon calibration program). In addition, when dates were determined on samples of marine shell the parameter file South Africa marine 1993, specifically west coast (WC93) was used for calibration (Talma & Vogel 1993). All uncalibrated dates are reported as years before present (BP), while all calibrated dates are reported as either years BC or AD.

Lithics

Jayson Orton identified the lithics artefacts, as he had already developed an interest in this region when the project began. He is also working on the artefact assemblages from a number of other sites in Namaqualand. The lithics are identified and categorised following J. Deacon (1972, 1984b).

Bone

The identification of bone artefacts follows Schweitzer (1979). The faunal remains were identified by comparison with bone in the mammal reference collection housed at the Iziko South African Museum in Cape Town. Each fragment was identified to its lowest possible taxon and unidentifiable fragments were grouped and recorded according to size. The element, side, end, proportion, age at death, and sex were identified for each bone when possible. Each fragment was also examined for evidence of taphonomic processes such as weathering (Behrensmeyer 1978), carnivore/rodent modifications acid etching, cut marks, heat alteration (Lyman 1994), and fresh spiral breakage versus dry bone transverse fracturing (Johnson 1985). The data is presented in standard measures of NISP (number of identified specimens), MNI (minimum number of individuals), and Relative Abundance (total number of elements/(MNI*the number of those elements in a single skeleton). I chose not to use MNE (minimum number of elements) or MAU (minimal animal units) because these measurements tend to over-estimate the number of animals in the assemblage. Instead, I used MNI in conjunction with the age profiles to identify the number of animals in each assemblage. This will also allow for future comparisons of these assemblages with previous faunal analyses, as the majority of Later Stone Age faunal analyses in southern Africa are conducted by either Richard Klein or Kathy Cruz-Uribe, both of whom consistently use MNI. When discussing micromammals, I used the measure Relative Abundance, as it is the standard that micromammal specialists use (Andrews 1990).

As bone density and food utility values were not available for the local bovids, data derived for sheep (*Ovis aries*) was used.

Shannon's Evenness Index is a statistical tool that compares the expected number of elements versus the observed number of elements per species, based on the standard food utility index (Metcalf and Jones 1988). A complete carcass (unconstrained) will have a value of 1.00, while an animal that has been butchered and the gourmet meat pieces returned to site will have a value closer to 0.369 (see Faith & Gordon 2006 for a full explanation and table of values).

Crayfish (*Jasus lalandii*)

Crayfish mandibles were counted and the lengths of complete specimens measured. This enabled derivation of total carapace length based on the study of Jerardino *et al.* (2001), which provides equations based on mean length for left and right mandibles:

Carapace length (mm) based on left mandibles= 9.83 + 6.29 x (mean length)

Carapace length (mm) based on right mandibles= 8.44 + 6.01 x (mean length)

Shellfish

The sub-sample of shellfish from each site is separated into the various species and counted. MNI's are based on complete shells, plus the apices of fragmented gastropods, or the highest number of hinge fragments for bivalves. MNI's may consist of the sum of individuals from many squares across the site. If shells are sufficiently complete, the total length is measured and recorded. There is a 10:1 relationship between the maximum length of a black mussel (*Choromytilus meridionalis*) and the maximum width of the prismatic band (Buchanan 1985b). Therefore, lengths can also be determined from some fragmented black mussels. When calculating mean sizes of the shellfish, juveniles were included, even if they were probably not purposely collected.

Kilojoules

The total number of available kilojoules in the assemblage is estimated by summing the values derived for each species, based on the KJ/g values obtained by Buchanan (1985a) and the assumption that 55-60% of an animals weight is edible. The derivation of the kilojoules per species is straightforward multiplying 60% of an average adult weight (in grams) by the KJ/g value obtained for that species, although juveniles and sexually dimorphic species must be accounted for. Juveniles of all species are assumed to be 60% of the average adult body weight, while the sex of sexually dimorphic species such as Cape fur seals must be identified in order to determine fairly accurate results, as adult males average 175kg, while adult females average only 40kg. When the sex of a seal could not be identified, I used the smaller female values in order to prevent over estimating the importance of seals. Finally, the KJ/g value for the category bovid size class II (BovII), including species such as grey duiker (*Sylvicapra grimmia*), springbok (*Antidorcas marsupialis*) and sheep (*Ovis aries*), used in this thesis, was based on the average for springbok and sheep the two ends of the size spectrum.

The estimates for shellfish require an additional step in the calculation, since shellfish were sub-sampled. For example, if the *Cymbula granatina* sub-sample has a mean length of 55.0mm then an animal this size provides 34.4KJ (Buchanan 1985a). In order to compare the total number of kilojoules available from shellfish to the other species identified at the site, which were not sub-sampled, the number of shellfish needs to be normalised. Continuing with the example, if there are 416 *C. granatina* shells in a sub-sample taken from 1.25m^2, there should be 1,508 shells from an entire site measuring 7.25m^2, providing a total of 51,875.2KJ for the site.

Crayfish also require further derivation to obtain an average number of kilojoules per animal, but first, the carapace length must be converted to weight in grams. Following Hayden (1969):

Males: wt (grams)=0.2885 x (length of carapace in cm) $^{2.6956}$

Females: wt (grams)=0.188 x (length of carapace in cm) $^{2.9885}$

As the sex of the animals is unknown, the values for males and females are averaged and multiplied by 3.98KJ/g, the figure obtained by Buchanan (1985a) for crayfish.

These estimates of the numbers of kilojoules contributed by different species can only be an approximation. I am aware that different categories of food remains may not be equally susceptible to post-depositional degradation leading to systematic biases. It is reasonable to assume, however, that any such biases are likely to be similar from site to site. I use the kilojoule estimates for comparative purposes only, in order to identify inter-site differences and similarities, not to attempt complete dietary reconstructions.

Stable Isotope Analysis

Stable carbon and nitrogen isotope ratios ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) were measured at the Archaeometry Laboratory at the University of Cape Town. Small samples of bone were decalcified using c. 2% hydrochloric acid, and rinsed in distilled water. The archaeological bone samples were then soaked in 0.1M sodium hydroxide overnight, and finally in distilled water until neutral. The resulting bone collagen was freeze-dried. For most samples, the isotope ratios were measured on a Finnigan-MAT 252 ratio mass spectrometer coupled with a Carlo-Erba preparation unit. Some samples were measured on a Delta Plus XP instrument, also with on-line combustion system. The reproducibility of the method for homogenous sample material is better than 0.2‰

Chapter Five: SK400-The Springbok Midden

Figure 5.1. Archaeological material in the sieve at SK400

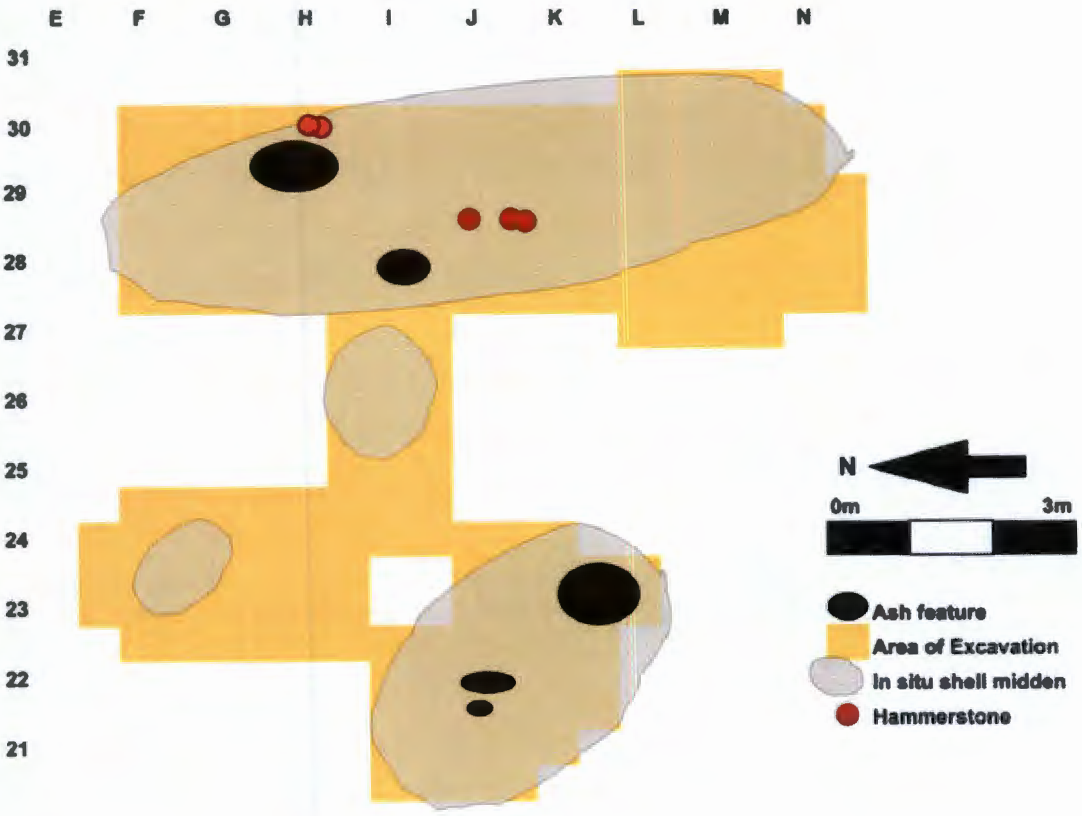
Introduction

The site of SK400 (officially KN2001/026 but also known as The Springbok Midden) is an open-air shell midden within a cluster of middens, located on the Namaqualand coast of the Northern Cape province of South Africa (29° 40' 57.0" S 17° 3' 46.9" E). The site is on the outskirts of the DeBeers mining town of Kleinsee (Fig. 1.5), 800 meters inland from the Atlantic Ocean and a kilometre south of the Buffels River mouth. SK400 was originally identified by members of the Archaeology Contracts Office in 2001 during the archaeological assessment of potential mine blocks within DeBeers property (Halkett 2003). During the phase two assessment of the mine block in 2002, it was noticed that SK400 was rich in bovid remains. Thus, in 2003 excavations were carried out to gather a large enough sample to characterise the site.

Excavation

The site was excavated in 50 cm^2 units using standard trowels, pans, buckets, a 3.0mm sieve and 1.5 mm sieves in order to recover very small artefacts. In all 51.25 m^2 was excavated for a total of 8.85 m^3 of midden (Fig. 5.2). The site was excavated stratigraphically down to sterile sand and all archaeological material was collected and taken to the University of Cape Town. There are four in-situ middens although the largest one at 9m in long at the eastern end of the site was poorly compacted and consisted primarily of bone. The three other middens are a northwest midden 1m in diameter, a southwest midden 5m in length, and a central shell patch, 2m in diameter.

Figure 5.2 **Plan of SK400**



Stratigraphy

A total of three archaeological layers and one sterile lens were identified, however only the surface and lower layers were consistent across the site. Layer "Lower2" was limited to a single 50cm^2 quadrant, J22D. The layers consisted of white or yellowish sand with discrete dumps of material refuse that are for the most part homogenous.

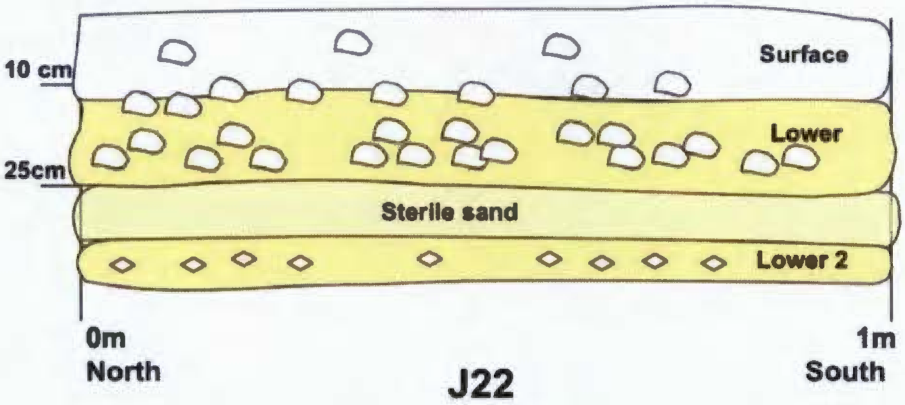
Surface material was removed over 51.25m^2 (Fig. 5.2) at an average depth of 12cm (Fig. 5.3) so that altogether 6.15m^3 of deposit was removed. The sediment consisted of white sand with discrete pockets of archaeological material.

The lower layer was excavated across 19m^2 (Fig. 5.2) with an average thickness of 13cm (Fig. 5.3). Altogether 2.5m^3 of deposit was removed. This layer consisted of yellowish sand with discrete pockets of archaeological material. Beneath the lower layer was sterile yellowish sand, except in J22D.

Lower 2 was collected across 0.5m^2 (Fig. 5.2). The average thickness of the layer was 6cm (Fig. 5.3), so that altogether 0.03m^3 was removed. The layer lay beneath a sterile sand lens and consisted of yellowish sand with a pocket of limpet shell and quartz debitage. This layer was highly localised and found only in the southern edge of the site in square J22D.

In summary, the surface and lower layers were similar with the exception of the soil colour, while lower 2 is a limited focused layer found only in unit J22D.

Figure 5.3 **Schematic profile of SK400. The intersection between J21 and J22. All the other squares had only the surface and lower layers. The diamonds denote the presence of stone in lower layer 2, while the limpets identify the shell midden layers.**



Features

The only features identified at SK400 are two robust ash patches, one in the east patch measuring 1m in diameter and one in the southwest midden also 1m in diameter. There are also three smaller ash dumps, one in the east midden at 30x50cm and two in the southwestern midden, one is 50x 20cm and the other is 20x20cm (Fig. 5.2). The ash dumps consisted primarily of ash, burnt bone, and burnt limpets, although the large ash dump in the southwestern midden lacked burnt bone.

Radiocarbon dates

Three radiocarbon dates were obtained for the SK400 from springbok bone, one from the lower layer and two from the surface layer. The radiocarbon date from the lower layer is 420±45 BP (Pta-9124) with a corresponding calibrated radiocarbon date of 1478AD (1459-1504; 1603-1612). The first radiocarbon date for the surface layer is 370±45 BP (Pta-9124) with a corresponding calibrated radiocarbon date of 1482AD (1521, 1576, 1627) 1641AD. The second date from the surface is 430±45 BP (Pta-9099), with a corresponding calibrated radiocarbon date of 1469AD (1445-1513; 1594-1620).

These dates are consistent with a single event or occupation as they are indistinguishable from one another at two standard deviations. This indicates that the site was used over a short period of time, which corresponds to the shallowness of the deposit. Thus, the site will be discussed as a single occupation layer.

Spatial distribution of archaeological material

The artefacts identified at SK400 include lithics, pottery, ostrich eggshell body fragments and beads, bone, crayfish mandibles, and shellfish. The lithics are scattered across the site, but there are three dense concentrations, one in the northwest midden, one in the southwest midden, and one in the large east midden (Fig. 5.4). The hammerstones are all found in the east midden (Fig. 5.2). The pottery sherds are primarily located in the east midden, although there is a dense patch near the northwest midden, and a few sherds near the southwest patch (Fig. 5.5). Ostrich eggshell is most densely concentrated in the southern end of the east midden (Fig. 5.6), but there are also small concentrations near the northwest, southwest, and central middens. The beads on the other hand are nearly all found in the east midden, with a few scattered across the western end of the site (Fig. 5.6). The bone is scattered across the entire site except for the southern end of the east midden, which is nearly devoid of bone. This is of interest as the east patch has the densest concentration by far with one quadrant (H29a) having over 3000 bones. The other middens also have small patches of densely packed bone, but nothing like the east midden (Fig. 5.7). Crayfish mandibles are scattered across the site with the highest density in the east midden (Fig. 5.8). The shellfish was sub-sampled and there is unfortunately no data on spatial distribution, other than the drawings of the in situ middens. While there is clear spatial patterning, there is no indication of areas divided by different gender activities (cf. Wadley 1987).

As there was no difference in the distribution of the remains between the layers and the radiocarbon dates are so similar, the analysis will assume there is a single occupation layer.

Figure 5.4 **The spatial distribution of lithics at SK400. The values are number of lithics per square. Blue highlights the most densely concentrated areas with values greater than 8 lithics per square**

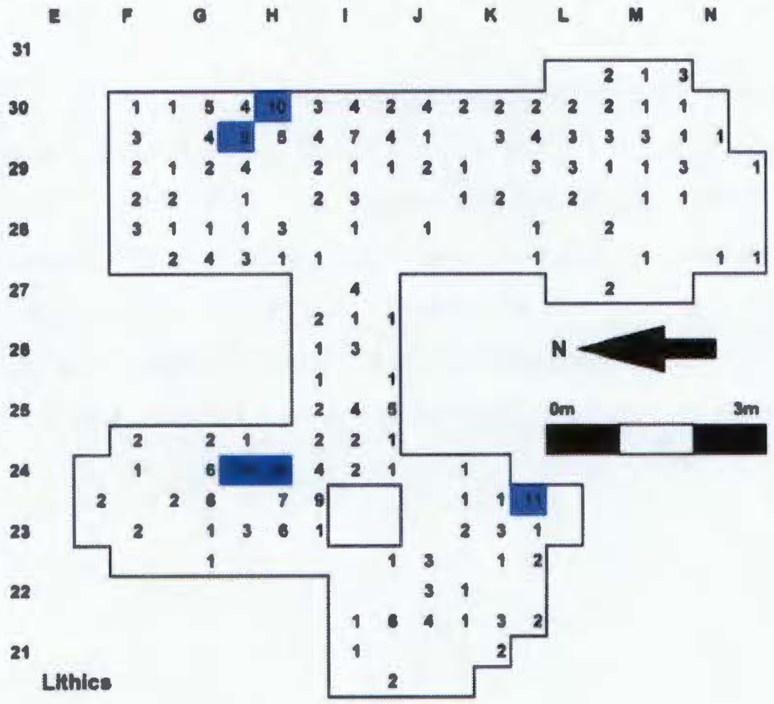


Figure 5.5 The spatial distribution of pottery at SK400. The values are number of pottery sherds per square. Pink highlights the most densely concentrated areas with values greater than two sherds per square

Figure 5.6 The spatial distribution of ostrich eggshell at SK400. The left map shows the distribution of ostrich eggshell fragments, while the right map shows the distribution of ostrich eggshell beads. Values are numbers of eggshell or beads per square. Orange highlights the most densely concentrated areas with values greater than four fragments per square and values greater than two beads per square

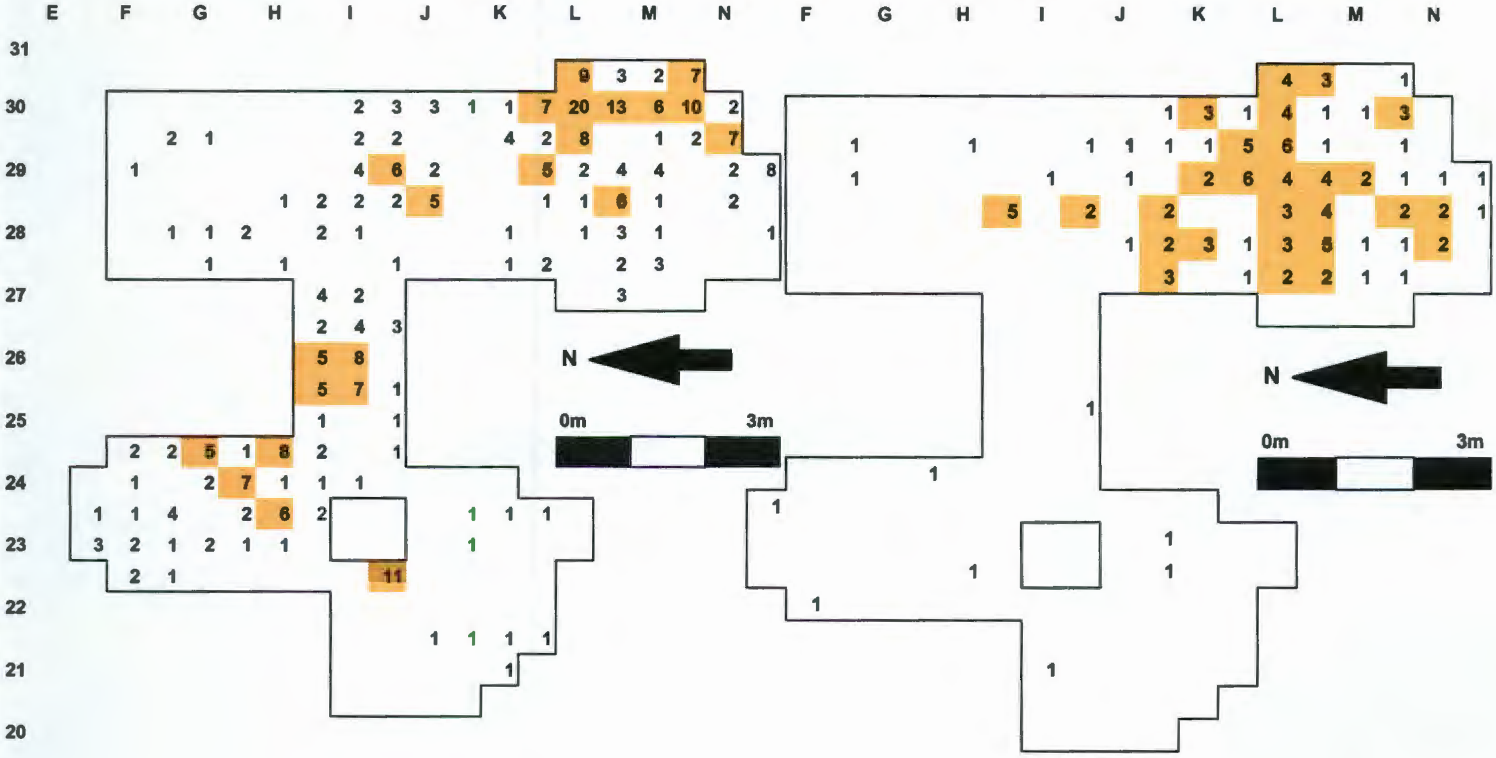


Figure 5.7 The spatial distribution of bone at SK400. The values are bones per square. Note H29A has over 3000 bones per square. Green highlights the most densely concentrated areas with values greater than 100 bones per square

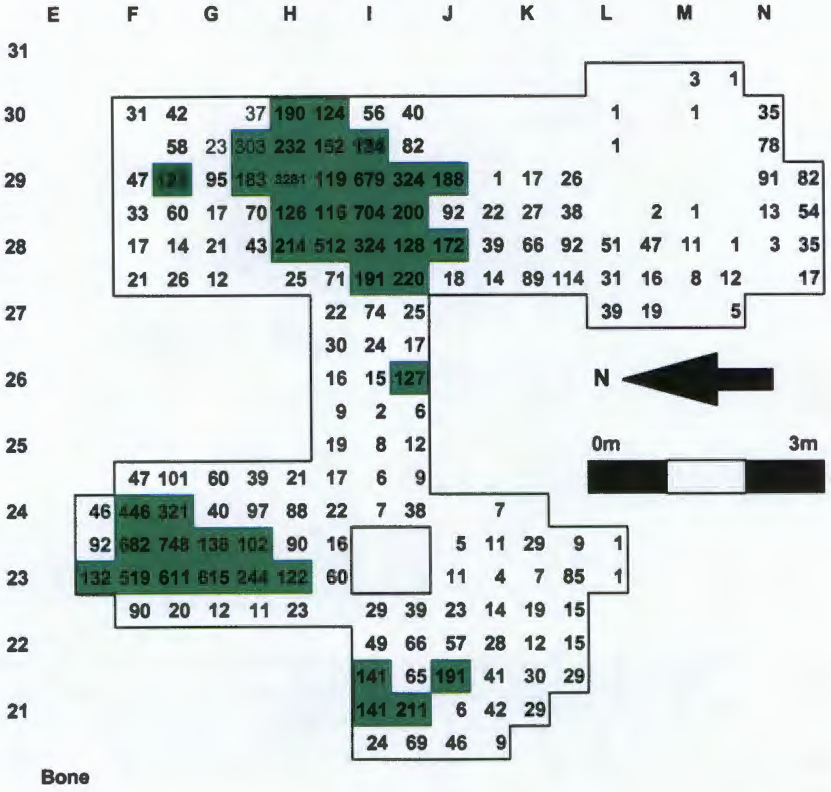
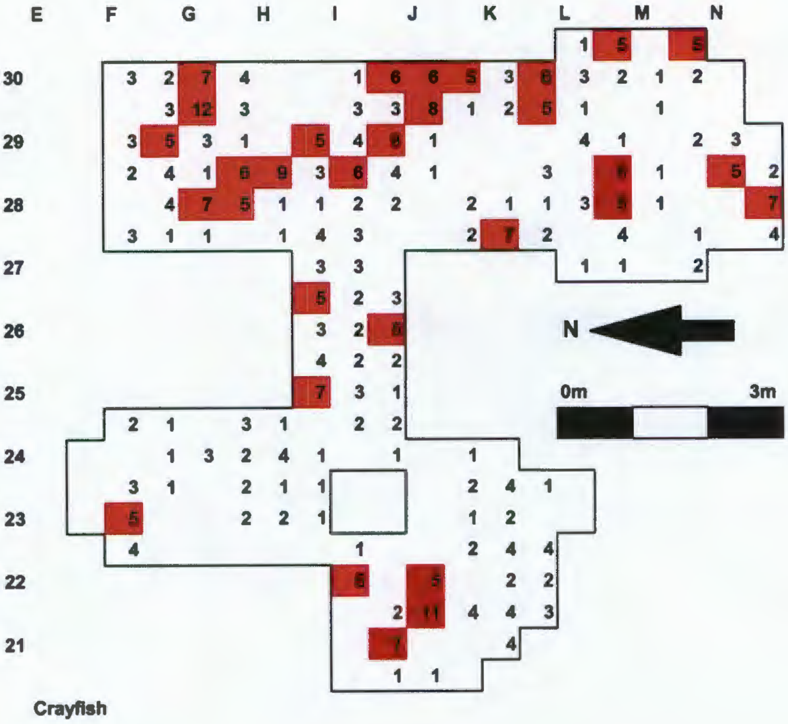


Figure 5.8 The spatial distribution of crayfish mandibles at SK400. Values are number of crayfish mandibles per square. Red highlights the most densely concentrated areas with values greater than four mandibles per square



Lithics

Table 5.1 **Lithic raw materials at SK400**

Stone	No.	%No.
Milky quartz	343	83.4
Tabular quartzite	43	10.5
Other	10	2.4
CCS	8	2.2
Silcrete	3	1.0
Quartzite	2	0.7
Sandstone	1	0.2
Total	**410**	**100**
Specularite light	1062.6g	
Specularite dark	11.5g	

The stone assemblage was analysed by Jayson Orton and consists of 410 lithic artefacts (Table 1) at 93.7% milky quartz. Other raw materials include tabular quartzite, an unidentified coarse-grained material, cryptocrystalline silicate (CCS), silcrete, quartzite, sandstone, and specularite. There are only three formal tools, all miscellaneous retouched pieces on milky quartz accounting for 0.9% of the assemblage (Table 2). Debitage is typical of an expedient flake industry and consists of flakes, chips, and chunks accounting for 87.8% of the assemblage. There are also 8 edge-damaged flakes (Table 2). Cores account for 2.7% of the assemblage and consist of bipolar and irregular forms (Table 2). Coarse-grained tool forms include hammerstones, upper grindstones, and lower grindstone fragments making up 2.4% of the lithic artefacts (Tables 2&3). There are also a few manuports. In addition, there are two forms of specularite in the assemblage, light green/grey and a dark grey variety.

Table 5.2 **Fine-grained material lithics assemblage at SK400**

Stone	No.	%No.
Milky Quartz		
Miscellaneous retouched piece	3	0.7
Formals sub total	**3**	**0.7**
Edge-damaged/ sub total	**8**	**2.0**
Bladelet	10	2.4
Flake	118	28.8
Chunk	111	27.1
Chip	82	20.0
Debitage sub total	**321**	**78.3**
Bipolar core	5	1.2
Irregular core	6	1.5
Cores sub total	**11**	**2.7**
Hammerstone sub total	**1**	**2.4**
Silcrete		
Flake	3	0.7
Debitage sub total	**3**	**0.7**
CCS		
Flake	6	1.5
Chunk	2	0.5
Debitage sub total	**8**	**2.0**

Specularite has been used historically in pottery as an admixture with the temper (cf. Bleek and Lloyd 1911: 343) and as a body decoration (Humphreys & Thackeray 1983).

This resource is clearly important it has been found in ostrich eggshell caches around the Northern Cape (Humphreys 1974).

The presence of debitage, cores, and hammerstones identifies that some form of expedient flakes making activity occurred at SK400. The presence of upper grindstones and lower grindstone fragments suggests that grinding activities occurred at SK400, but it is of note that the lower grindstones are fragmented despite the fact that whole lower grindstones are common in the region. The most likely substance being ground is the specularite.

Table 5.3 Coarse-grained material lithics assemblage at SK400

Stone	No.	%No.
Tabular Quartzite		
Flake	8	2.0
Chunk	19	4.6
Chip	8	2.0
Debitage sub total	**35**	**8.5**
Lower grindstone fragment	3	0.7
Grindstone sub total	**3**	**0.7**
Manuport	**5**	**1.2**
Sandstone		
Chunk/ debitage sub total	**1**	**0.2**
Quartzite		
Lower grindstone fragment	1	0.2
Hammerstone/grindstone	1	0.2
Hammerstone/grindstone sub total	**2**	**0.5**
Other		
Manuport	**5**	**1.2**
Lower grindstone	2	0.5
Hammerstone/grindstone	3	0.7
Hammerstone/grindstone sub total	**10**	**2.4**

Pottery

A total of 160 potsherds were recovered from the site, weighing 633.2g. The mean thickness of the sherds is 6.0 ± 1.7 mm ranging from 2.0–11.3 mm. Five rim sherds were found on the surface. A single rim sherd is decorated with two parallel rows of impressed dots (Fig. 5.9); this design is typical of Cape coastal ware (Sadr and Smith 1991) found commonly along the west coast and in the Cape Fold Belt within the past 700 years. Three sherds were complete enough to determine the diameter of the original opening: two rims are from pots with a 10 cm diameter mouth, while one rim is from a pot with a 20cm diameter mouth. Two rims are too small to determine the diameters of the original pots. Of the five rims, the decorated rim has a rounded lip while three others have flat lips. The fifth and smallest rim is too eroded to determine the lip form. The majority of the pottery had a quartz temper that ranged from fine to coarse and 116 or 73% of the sherds had a specularite admixture. The exterior of nine sherds shows evidence of an ochre burnishing, although the surfaces of some sherds are too eroded to see. The pots exhibit evidence of being coiled. There are no lugs, although one body sherd looks as if it has been reinforced internally, like the edge of a lug. Only a small portion of this feature is preserved. There are no base fragments that would clarify the shape of the vessels.

Figure 5.9 The decorated rim fragment at SK400

Ostrich Eggshell

Fragments

Ostrich eggshell (OES) is present on the site as fragments, beads, and flask mouths. The site produced a total of 342 ostrich eggshell fragments weighing 300.5g. There are fourteen flask mouth fragments, identified by the presence grounded edges on the hole. Some of the flask mouth fragments also exhibit an oblique angle of breakage. Three of the flask mouth fragments have a mouth diameter of 9.5mm, while the other two fragments have a diameter of 18mm. None of the flask mouths refit.

Beads

There are 182 finished stage 11 and three unfinished stage 10 beads (Kandel & Conard 2005. The beads are large with a mean external diameter of 7.4±1.4mm ranging from 2.9 -10.5 mm (Fig. 5.10). While the bulk of the beads are large and average 7.5mm, a large number are clustered around the 5.0mm size. This suggests a bimodal distribution, perhaps indicating that there were two different strings of beads? (Figs 5.10 & 5.11). The mean aperture is 2.4±0.4mm ranging from 1.7-3.2mm (Fig. 5.11). Most of the beads are circular with the aperture located in the centre of the bead, although there are examples of worn elliptical beads with apertures to the side.

Figure 5.10 **Bar graph showing the distribution of external diameters of ostrich eggshell bead beads at SK400**

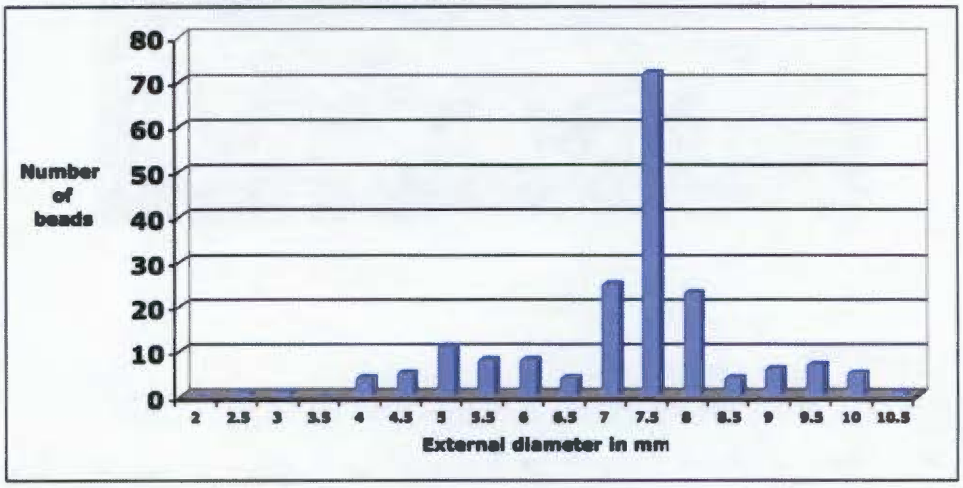
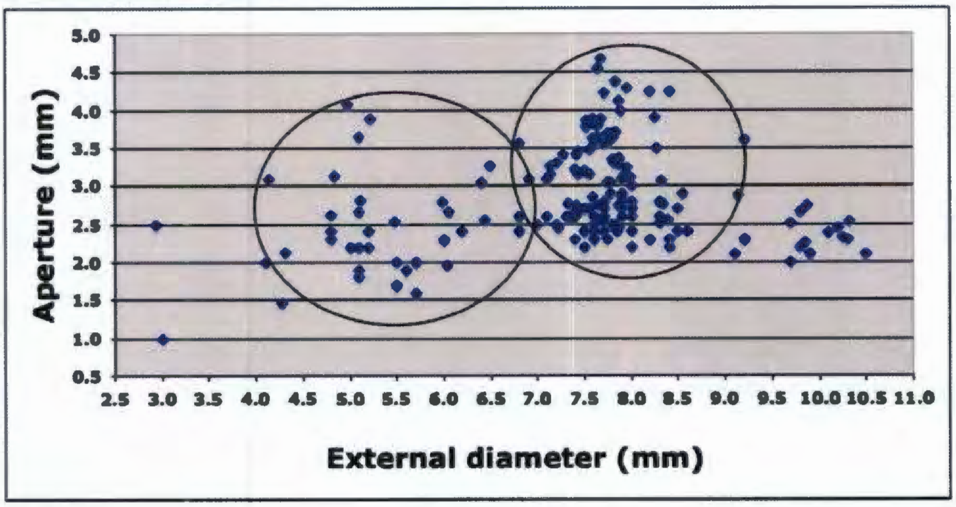


Figure 5.11 The external diameter versus aperture size of ostrich eggshell beads at SK400. Note the bimodal distribution



Shell artefacts

Two water worn *Conus* sp. shells have been perforated with wear facets (Fig. 5.12).

Figure 5.12 Conus shell pendants from SK400

Bone

Artefacts

There is a single piece of tortoise carapace with a smoothed edge, which may have been part of a bowl.

Subsistence Strategy

While the sample is fragmented, bone tissue is well preserved, and small fragile bones such as hyoids are present. The assemblage yielded 20,330 specimens but due to fragmentation, only 1,221 were identified to species (Table 5.4).

95.5% of the specimens identified to species are springbok (*Antidorcas marsupialis*). The MNI based on left mandibles is 42 (Table 5.4). Only two other identified species of mammal were present: an unidentified *Canis sp.* and a Cape fur seal (*Arctocephalus pusillus)* are represented by four fragments and mandible respectively.

Table 5.4 **The identified vertebrate species at SK400**

Taxon		NISP	MNI
Springbok	*Antidorcas marsupialis*	1,216	42
Bovid size class II		5,477	123
Cape Fur Seal	*Arctocephalus pusillus*	1	1
Canis sp.		4	1
Small-medium mammal		13,000	/
Fish		616	2
Angulate tortoise	*Chersina angulata*	9	1
Snake sp.		6	1
Small Aves		1	1
Total		**20,330**	**130**

This lack of species abundance is interesting in itself as faunal reports from other Later Stone Age sites in southern Africa tend to have long species lists (Humphreys & Thackeray 1983, Klein 1978a, Klein and Cruz-Uribe 1989 Plug 1993, Schweitzer 1979). Among bones identified to the family level, only small to medium size bovids (bovid size II) are present. In Namaqualand, this size family includes springbok (*Antidorcas marsupialis*), sheep (*Ovis aries*), and grey duiker (*Sylvicapra grimmia*). In total, 5477 elements were identified to bovid size

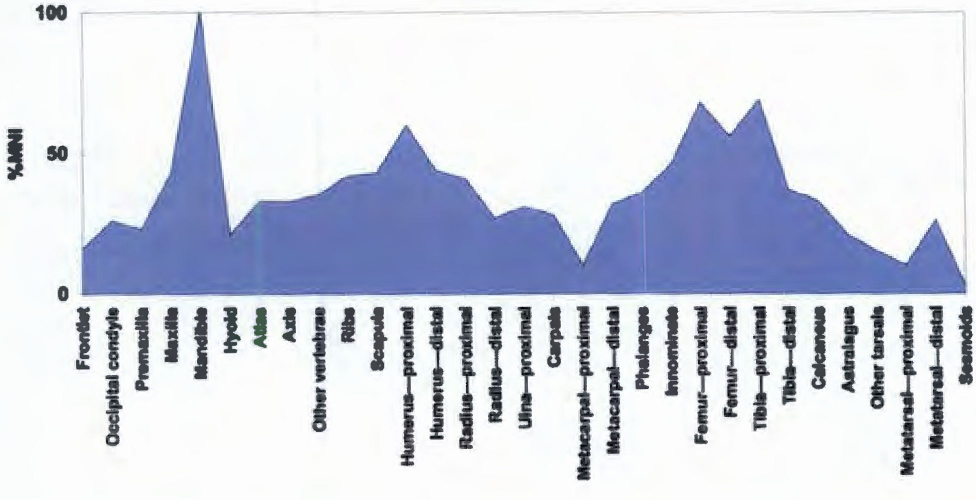
II and considering the absence of any securely identified grey duiker or sheep in the sample, the bovid size II remains are likely all to be springbok, giving a total MNI of 123 based on left mandibles including springbok. The only other category with an abundance of bone is the small to medium mammals consisting of shattered long bone, rib, and cranial fragments too small to identify to taxon below size class. The subsistence strategy reflected at this site is therefore clearly one of intensive exploitation of bovid size II. This report will proceed on the basis that these remains all derive from the single securely identified species in this size class, namely springbok.

Springbok (Antidorcas marsupialis)

Element Distribution

The element distribution graph (Fig. 5.13) shows that all skeletal elements are present in the sample, yet the abundance of each element is not representative of anatomical completeness: for example there is a much lower frequency of proximal metapodials at 4 %MNI in comparison to the mandibles at 100 %MNI.

Figure 5.13 **Element distribution of BovII (including springbok) from SK400. The y-axis depicts %MNI with mandibles at 100%, while the x-axis are the elements present in the sample**



Proximal metapodials have a high proportion of cancellous bone, which is more susceptible to the effects of post-depositional processes than compact bone, however it is unlikely that post-depositional processes are the cause for the missing elements as other more delicate bones such as hyoids are abundant. Marean's (1991) completeness index (CI) suggests that post-depositional processes can be identified by a high frequency of damaged tarsal/carpals in a sample, since neither humans nor carnivores damage these dense bones. Of 39 tali, 96% were whole, while all 21 naviculo-cuboids were complete. Comparing the %MNI against Lyman's (1985) Bone Density Index (using Lam *et al's* (1999) density values) it is clear that post-depositional attrition is not responsible for the bone loss as the correlation or Pearman's r^2=0.034. The presence of all skeletal elements in the sample, albeit in varying numbers, indicates that the animals were killed and butchered nearby. Considering the large number of carcasses to process, one would assume that the "Schlepp effect" (Perkins & Daly 1968) or various economic transport decisions might be affecting what elements are returned to the site. Comparing the %MNI of the highest utility elements (Fig. 5.14), the most robust bones that are the most likely to survive in their original frequencies, to the Standardized food utility index (Metcalf & Jones 1988) and applying Shannon's evenness index, suggests that economic decisions were affecting the bone assemblage (Table 5.5).

Figure 5.14 **The correlation between the %MNI for bovid size II (including springbok) bone and the standard food utility index at SK400. Only the high utility bones were used**

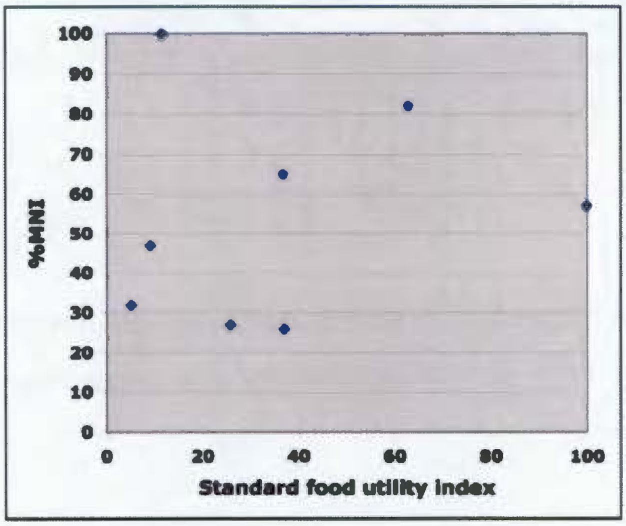


Table 5.5 **The %MNI versus standard food utility index for BovII including springbok from SK400**

Element	SFUI	%MNI
Femur	100.0	68
Tibia	62.8	69
Metatarsal	37.0	26
Humerus	36.8	60
Radius	25.8	41
Mandible	11.5	100
Cranium	9.1	43
Metacarpal	5.2	32
N	6693	
Evenness	0.595	
Shannon's Rho	0.2857	
P	0.4927	
Result	Gourmet & Unconstrained	

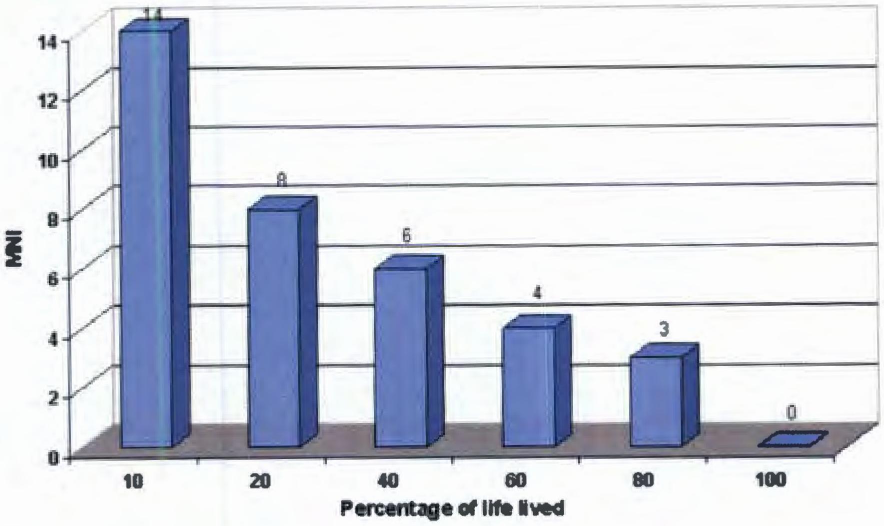
Shannon's evenness index returned a value of 0.595, which is consistent with a gourmet strategy (Binford 1978, Faith & Gordon 2006), whereby people maximized the quality of available meat. However, the Spearman's rho value of 0.2857 (p=0.4927) is consistent with an unconstrained strategy, where the whole carcass is returned to the site. Perhaps these results are due to the fact that both of these strategies were used. If SK400 is close to the kill site, then many carcasses would have been returned whole, especially as springbok are only 26kg. However, as there are over 120 animals, people may have turned to a gourmet strategy, leaving the lower legs and feet behind and taking only the highest utility elements to process at SK400.

Age and sex profile

Determining the sex of faunal remains is species-specific and difficult at best. For most bovids, identification of sex is based on morphological differences between sexes such as horn core shape, pelvis shape, and overall size differences due to sexual dimorphism. Consequently, sex can be determined only for fully-grown adults. While there were no pelves in the sample that were sufficiently intact for sex estimation, there were several horn cores from which two adult females and three adult males could be identified. The presence of both male and female springbok is interesting, as springbok herd behaviour dictates that the sexes live in separate small herds for most of the year, with the females and the juveniles together in a harem herd and males together in a bachelor herd. The only time that both sexes intermingle in this region is at the beginning of the wet winter season when fresh grass is available and mating takes place (Estes 1991), or, on rare occasions, in the summer months during extreme droughts every ten to twenty years, when thirsty springbok have been known to congregate in their thousands and head for the sea in a stupor like lemmings (Estes 1991, Skead 1980). In order to shed some light on the season of occupation of the site, a mortality profile was required.

Utilizing species-specific dental eruption and wear patterns, age-at-death can be determined. The timing of the eruption of individual teeth is consistent within a species and once calculated can be used to gauge the dental ages of other individuals of that species. However, eruption rates can only be used on juvenile and young adult jaws, before the adult dentition has fully emerged. In order to estimate the age of mature adult dentition, one must turn to the estimated rate of tooth wear. This is less precise than using eruption rates since environment can affect the rate of wear. An individual living in a sandy environment will wear its teeth faster than an individual living in a grassland environment. The age-at-death for the dentition was determined following Rautenbach's (1971) criteria for estimating dental age of springbok. This technique uses both eruption and wear rates. It seems that the majority of the SK400 springbok were juveniles as shown by plotting the MNI in each age category (Fig 5.15). This graph demonstrates a classic catastrophic mortality profile with 40% of the animals in the youngest category and the distribution tailing off in the higher age classes.

Figure 5.15 **Catastrophic mortality profile of BovII (including springbok) at SK400. Ages are based on dental eruption and wear determined for springbok using Rautenbach (1971). The 100% life span for springbok is nine years**



As the average lifespan of springbok is 9 years, the 10% of lifespan category includes the youngest individuals or the juveniles born that year, represented by the first three mandibles in Fig. 5.16; the 20% of lifespan category includes the yearlings, or the fourth mandible in Fig. 5.16; 40% of lifespan individuals are the two to three year olds with low wear in Fig. 5.17 and the bottom mandible in Fig. 5.17; the 60% of lifespan individuals are the four and five years olds with moderate wear in Fig. 5.17; the 80% lifespan are the six and seven year olds with heavy wear, while the 100% of lifespan individuals are the eight and nine year olds with extremely heavy wear seen in Fig. 5.17. The catastrophic mortality profile supports the above data on the sex of the adults by suggesting that the individuals were hunted as a herd, without selection for individuals of specific ages.

In the youngest age category, the mandibles are all the same age, a fact that can be used to determine the seasonality of the site. In all fourteen individuals, the first cusp of the second molar is just beginning to erupt through the alveolar bone signifying an age of between four and five months. In Namaqualand, wild springbok are born within a few weeks of each other in July (Skinner *et al.* 2002, Skinner *et al.* 1977), indicating that the site was occupied in November/December, or early summer. Thus, the presence of both male and female adult springbok, the catastrophic mortality profile including all age ranges, and the tight clustering of the age of the juveniles indicates a summer season of death. All these observations therefore suggest that the springbok were killed during a drought trek, the only occasion when both sexes and all ages of springbok are together as a single herd during summer months.

Figure 5.16 **Lateral view of juvenile springbok mandibles depicting the stages of eruption used in age recognition, from Rautenbach (1971)**

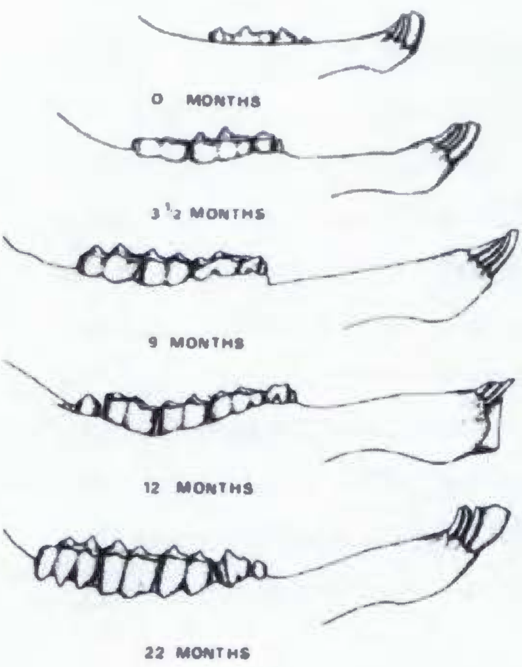
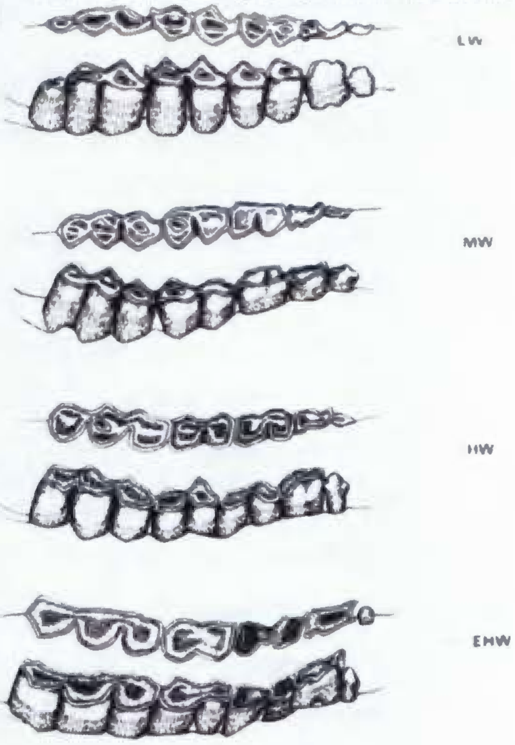


Figure 5.17 **Detailed view of mandibular teeth of adult springbok showing wear stages. LW=light wear 2-3.5 years, MW= moderate wear 3.5-5.5 years, HW= heavy wear 5.5-7.5 years, and EHW= extra heavy wear 7.5+ years, from Rautenbach (1971)**



Historic and ethnographic records

Early travelers' records described these massive herds of springbok: "...the springbok divided themselves into large flocks of at least twenty or thirty thousand in each flock..." (Paterson 1790) and "Of Namaqualand in general, during 1860 or thereabouts... even within a recent period drought in the interior has driven innumerable herds across the Orange River far into the heart of the Colony...About 14 years since such an inroad was made by the 'trek' springbok into Little Namaqualand where there was neither grass nor water for them, consequently they perished in the thousands. Many of them ran into the sea to drink, and were drowned" (Dunn 1875). SK400 appears to be the first archaeological site that records people exploiting this phenomenon.

There is also ethnographic evidence of the exploitation of springbok herds by the /Xam San, a group from the Northern Cape who were interviewed only a few hundred years after the time of occupation of SK400 (Bleek & Lloyd 1911). /Xam informants described a trap specifically designed to hunt large herds of springbok (Bleek & Lloyd 1911) (Fig. 5.18). While it is most likely that the traps described were used during the normal congregation and migration of springbok in the winter months, the same trap could have been used during one of these summer treks. The trap was made by tying ostrich feathers to sticks and placing them in the ground in the shape of a shepherd's staff with a tight curl. Hunters would lie in hiding at the curved end while other people were stationed opposite the line of the staff. When the herd of springbok came near the trap, a *woman* (my emphasis) would throw dust in the air and make noises to confuse the animals, tricking them into running directly towards the trap. The springbok then ran into the line of sticks, forcing them to turn and run towards the hunters lying in wait. The use of traps like this would result in a catastrophic mortality profile such as that described above.

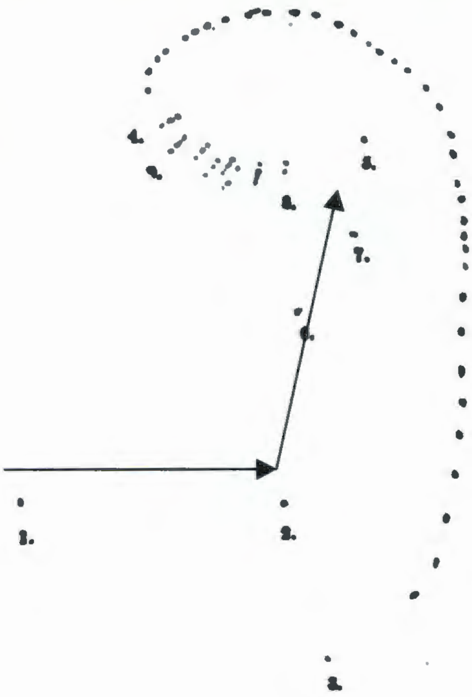


Figure 5.18 **Drawing of a springbok trap described by !Xam men to Bleek and Lloyd (1911: 288). The dots represent poles with ostrich feathers attached at the top. The springbok herd is driven into the trap from point 1 to point 2. A woman stands at point 3 throwing dust into the air to confuse the springbok and preventing them from avoiding the trap. The springbok turn up towards point 6, where a man holds a stick driving them towards the hunter lying in wait at points 4, 5, 8, and 9. Point 7 is a smaller stick with a feather on top**

Similar evidence of trapping entire herds of small ungulates during the Natufian period (14-11 ka) was identified archaeologically at the site of Tel Abu Hureyra in Syria (Legge & Rowley-Conwy 1987). At that site, *Gazella gazella* also represent over 80% of the faunal assemblage; displayed a catastrophic mortality profile; and exhibited a similar tight age clustering of the juveniles. Large stone structures in the region have been identified as gazelle traps, but ethnographic evidence from Syria also records the use of slender poles with rag pennants to frighten the herd into running towards hunters lying in wait (Legge & Rowley-Conwy 1987). It is noteworthy that Legge and Rowley-Conwy (1987) identified three prerequisites for trapping such large herds namely, predictable migration paths, large open areas, and many hunters. As population sizes are difficult to determine on many archaeological sites including SK400, we cannot say how many people are likely to have been involved in the capture of these animals. If we consider that 95% of bovid bones showed fresh spiral breakage and that at least 123 animals were processed, it is likely that a large group was required to hunt and rapidly process this many springbok. This is why I may speculate that men and women were present at the site.

Canis sp. (Black-backed jackal Canis mesomelas or domestic dog Canis familiaris)

A total of three premolars and an ulna represent a Canis, which is most likely a Black backed jackal, but could also be a domestic dog.

Cape fur seal (Arctocephalus pusillus)

There is a single left mandible from a Cape fur seal in the assemblage. There are no teeth but and the canine socket does not seem to have held a male tooth, suggesting it is female.

Angulate Tortoise (Chersina angulata)

There is very little evidence for the use of tortoise at this site as there were only nine tortoise bones in the sample, seven fragments of carapace and two humeri.

Snake

A total of six bones were identified to snake, two vertebrae and four ribs.

Small Aves

There is a single small bird tibiotarsus.

Small Fish

There are 662 fish bones representing a minimum of two fish. There are 159 vertebrae, 23 spines, 461 scales, and 18 cranial bones.

Bone Modifications

All bone was examined for surface modifications including weathering, carnivore/rodent gnaw marks, cut marks, heat alteration, and fresh spiral breakage versus dry bone transverse breaks (Table 5.5). Following Behrensmeyer's (1978) six stages of weathering, the few bones that did show signs of weathering (n=57) were assessed to be in stage 0. Weathering was therefore a minor factor affecting the preservation of bone.

Table 5.5 **Modifications identified on bone from SK400**

		Cut marks	**Burnt**	**Carnivore gnawing**	**Spiral breaks**	**Transverse breaks**	**Intermediate breaks**	**Weathered**
Total bone (N=20,330)	No.	25	5623	26	4252	41	832	57
	%No.	0.1%	27.6%	0.1%	20.9% (95% of long bones)	0.2%	4.1%	0.3%
BovII including springbok (N=6,693)	No.	25	736	26	1358	41	38	37
	%No.	0.4%	11.2%	0.4%	20.6% (95% of long bones)	0.6%	0.6%	0.6%

Carnivore and rodent gnawing was also a minor factor as only 0.1% of the total mammal bone exhibited evidence of gnawing or puncture marks. The infrequency of weathering damage and carnivore/rodent gnawing suggest that the faunal remains were probably covered (by other bones or sand and shells) soon after deposition, preventing these taphonomic factors from drastically affecting the bone.

While only 25 bones exhibited cut marks, all of these are on the bovid remains (0.4% of BovII incl. springbok) and are direct evidence of human behaviour. In addition to the presence of typical cut marks, two left scapulae were clearly pierced: there are small unhealed holes in the middle of the shoulder blades (Fig. 5.19). Noe-Nygaard (1975) identified the same pattern of bone damage on deer scapulae from Mesolithic Denmark.

Figure 5.19 **BovII (including springbok) scapulae from SK400 with unhealed fractures indicative of being attacked with human weapons (Noe-Ngaard 1975). The two complete scapulae on the left show perforation damage left by a point, while the five incomplete scapulae on the right appear to exhibit the same fracture pattern, as far as one can tell given the preservation**

She suggested that the most accurate way to kill an animal instantly is to sever the vital blood vessels just above the heart. This leaves an entry wound on the shoulder blade, precisely where the bone damage is found in this study. Clearly, there is direct evidence that at least two of the springbok were pierced with pointed weapons such as spears or arrows from a large powerful bow. Of the remaining scapulae in the sample, four left and two right exhibit damage at the same location. However, since the specimens are incomplete, one cannot be certain that the damage in these cases was pre-mortem. Four left and two right whole scapulae are unperforated and the remaining twenty-two scapula fragments are too incomplete to determine if they were perforated or not. The perforations of the two entry wounds show bevelling that identifies the direction of entry. On one scapula, the direction of entry is as expected for a standing animal being pierced in the heart, from the outside at a downward angle. The second scapula shows that this animal must have been lying on its side as the direction of entry is from the inside and at an upward angle.

Heat alteration is present on 27% of the mammal sample, with the bones being either charred (blackened) or calcined (whitened), indicating that these bones were in close contact with fire (Buikstra & Swegle 1989, Lyman 1994). Some bones were entirely burnt indicating that they had been defleshed when thrown into the fire, as meat on the bone protects the bone surface from the flames. As the burnt bone was found in association with ash dumps, it seems likely that the burned elements represent bone that was thrown into the fire after meat consumption or the processing of food remains rather than cooking.

The presence of percussion notches, fragmented long bones, and spiral fractures identifies that people were probably processing long bones for marrow (Johnson 1985, Lyman 1994). The percentage of oblique green spiral breaks was very high, being present on 95% of the long bones, indicating that the springbok were freshly dead when processed for marrow (Johnson 1985, Villa & Mahieu 1991). Right angled dry transverse breaks are also present in the long bones but at a much reduced frequency (only 0.2%of mammal bone). As it only takes a few days for bone to dry, the transverse breaks may have been caused by secondary fracturing (Johnson 1985) as it has already been shown that post-depositional compression did not affect the sample.

Crayfish (Jasus lalandii)

Crayfish mandibles were common with an MNI of 225 individuals based on left mandibles. The mean length of the left mandible is 12.1 ± 2.6 mm with a range of 7.5 – 17.6 mm while the mean length of the right mandibles is 12.7 ± 3.0 mm with a range of 8.3-19.9 mm. The mandible lengths were converted to carapace length following Jerardino *et al.* (2001). The results are a mean carapace length of 85.4 ± 16.1 mm with a range of 57.0-120.5 mm based on left mandibles and 84.9 ± 18.1 mm with a range of 58.3 -127.9 mm based on right mandibles.

Shellfish

Due to the large number of shellfish, the assemblage was sub-sampled in order to analyse species composition and size variations. There are six species of shellfish identified in the assemblage, dominated by three limpet species: *Cymbula granatina* (51.7%), *Scutellastra granularis* (37.5%), and *S. argenvillei* (4.7%) (Table 5.6). Other species in the assemblage include *S. barbara*, *Bullia sp.* and *Conus sp.* The shells of the dominant species were measured when possible. The mean length of the samples is: *C. granatina* 53.1±11.2mm, *S. granularis* 41.0±8.4mm, and *S. argenvillei* 69.4±11.3mm (Table 5.7).

Table 5.6 **The shellfish species identified at SK400**

Species	MNI	%assemblage
Cymbula granatina	1065	51.7
Scutellastra granularis	771	37.5
S. argenvillei	96	4.7
S. barbara	4	0.2
Conus sp	2	0.09
Bullia sp	1	0.05
Unidentified	117	5.7

Table 5.7 **The mean length and relevant statistics of the dominant shellfish species at SK400**

Species	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
C. granatina	309	53.1	11.2	8.1	83.0
S. granularis	452	41.0	8.4	18.1	70.1
S. argenvillei	39	69.4	11.3	38.0	90.3

The presence of *C. granatina* and *S. granularis* is a signal that people were exploiting the mid inter-tidal zone, which is accessible during a low tide. However, *S. argenvillei* live in the low inter-tidal zone, which is only accessible near or during a spring low tide. It is interesting that *Choromytilus meridionalis* is absent from the assemblage, as black mussels are quite common on the Namaqualand coast and grow on the same rocky outcrops as the limpets. Although *C. meridionalis* are filter feeders, heavily affected by local red tides that occur in late summer making them toxic. Perhaps people were intentionally avoiding this species.

Kilojoules

While SK400 is clearly dominated by springbok, it is important to derive the frequency of kilojoules from different categories in order to compare diets across sites.

Using the values derived by Buchanan (1985a), and the basic assumption that 55-60% of a species is consumable. SK400 is clearly dominated by terrestrial species versus marine foods (Fig. 5.20), with springbok providing the most kilojoules at 91% (Fig. 5.21 and Table 5.8). Shellfish account for 7% of the total dietary intake of kilojoules.

Figure 5.20 The ratio of terrestrial and marine kilojoules at SK400

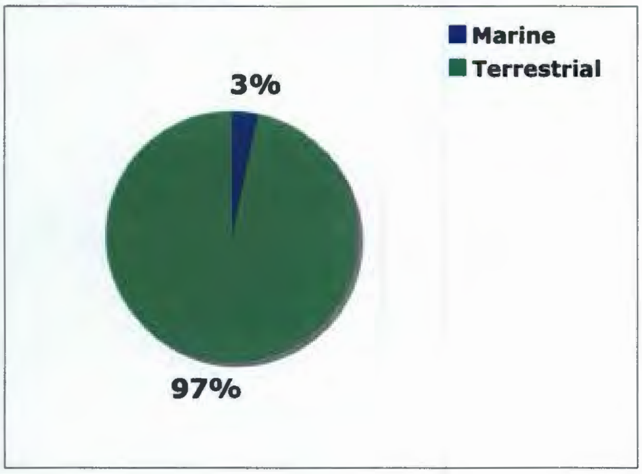


Figure 5.21 The distribution of kilojoules at SK400 by species

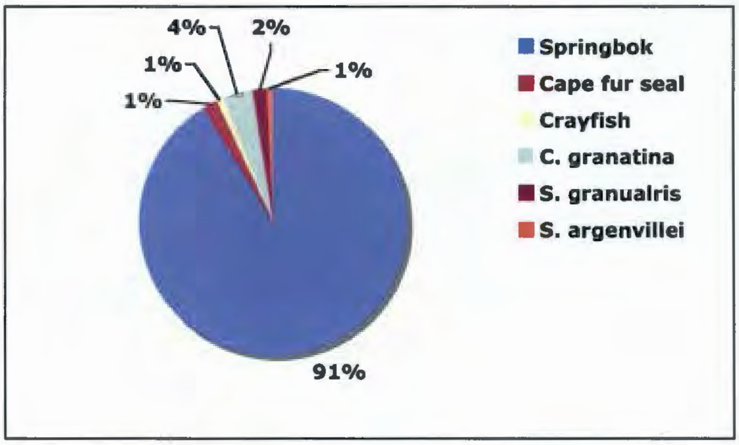


Table 5.8 **Kilojoules obtained from different categories of foods at SK400**

Taxon	KJ/animal	Number of individuals	Total KJ
BovII adults	100,300	81.9	8,214,570
juvenile	50,150	41.1	2,061,165
Cape fur seal	165,000	1	165,000
Small aves	4,000	1	4,000
Medium fish	2,000	1	2,000
Angulate tortoise	2,000	1	2,000
Crayfish	408.6	255	104,128
C. granatina	32.1	12,843	412249
S. granularis	21	9,297	195,237
S. argenvillei	70.6	1,158	81,754

Discussion and Conclusion

SK400 is an open-air shell midden located 800 m from the sea amongst a cluster of middens. The Buffels River is only one kilometre to the north. This river when dry is a direct pathway from the interior of the region, and when the river is flowing it can provide fresh water and fresh water resources such as frogs and water fowl (personal observation). The focus on containers (ostrich eggshell flask mouths, pottery, and tortoise bowl), which could have been used as water containers, and the identification of trekbokken, implies that the site was created during a serious drought. If the springbok came down the dry riverbed "pathway", people could easily have set a trap if they were knowledgeable of their surroundings.

The site has layers that have yielded statistically similar radiocarbon dates that most likely represent a single occupation at roughly 1480AD. There is one large midden and three smaller middens and while the distribution of residues across the site shows some spatial patterning, the only features present at the site are ash dumps. The lithic assemblage seems "made when needed," as there is a lack of formal stone tools and the raw materials are all local. The majority of the lithic assemblage is made up of milky quartz. Specularite is present and may have been used for body decoration and/or as an admixture in the making of pottery. Of note is the lack of complete lower grindstones, which are abundant in the region; however, the presence of upper grindstones suggests that there was some form of grinding.

The pottery assemblage is substantial at 160 sherds with temper made of fine to coarse quartz and specularite. Both rounded and flat rims are present and very few sherds exhibit evidence of burnishing. There is one decorated rim with incised punctuations. Ostrich eggshell is common at the site and includes 182 finished and three unfinished beads. There are two different sizes of beads, a group that average 5.0mm and another that average 7.5mm. While some of the beads show signs of wear, most seem new as they are still round and lack wear facets.

The only other non-lithic artefact at the site is the remnant of a probable tortoise shell bowl. Two *Conus* sp. shells may have been intended for use as pendants. The analysis of the faunal sample suggests a subsistence strategy exploiting an entire herd of springbok using traps during the summer months. The application of the standard food utility index in conjunction with Shannon's evenness index identified the use of two economic strategies: one was a gourmet strategy returning only the best cuts of meat to the site and the other was unconstrained, returning the whole carcass to the site. Of interest is the lack of evidence for the intensive exploitation of the Cape fur seal (*Arctocephalus pusillus*) rookery or the African penguin (*Spheniscus demersus*) hatchery. Perhaps the rookery and hatchery were not yet established. The identification of mass harvesting at this site is very interesting. As opposed to hunting single animals, mass harvesting a large quantity of a single species can alter its rank, necessitate the assistance of women in a role usually reserved for men, and provide a windfall that must be stored or shared.

Following optimal foraging theory or diet breadth models, people rank food types, focussing on items that provide the highest return rate for the energy expended in their procurement and processing. Large animals usually have the highest rank (Madsen & Schmitt 1988). Mass harvesting a low ranking species can alter its rank: for example, individually, grasshoppers are a low ranking species but collecting a cluster of over 10,000 grasshoppers has a higher return rate than a large bovid that has to be hunted, thus grasshoppers are a more efficient species to collect. In the case of SK400, it would have been more efficient to trap a herd of springbok than hunt a single gemsbok (*Oryx gazella*). The identification of a mass harvest of low ranked species becomes particularly important when interpreting the diet breadth of a site. A wide diet breadth, or the reliance on many species, particularly low ranked species, indicates inefficient hunting, or high work input for the return achieved. This pattern usually indicates a need to exploit a wide range of resources because the population is reaching the carrying capacity of the region. A narrow diet breadth, identified by the presence of a few species, or a dominant species, indicates efficient hunting practices, without population pressures. Thus, if an archaeological site is dominated by low ranked species, one may incorrectly infer that the site exhibits evidence for a wide diet breath because of the ranking of the prey, when in fact the site reflects a narrow diet breadth strategy, focussing on the abundance of a single species.

Mass harvesting also has the potential to temporarily alter gender roles, especially those of women. Biesele, in her ethnographic studies of the Kalahari Bushmen (1993), has argued that the southern African Bushmen or Khoisan identity has a dual but complementary character with the male/female cognitive opposition at the core. Maleness is associated with hunting, arrows, heat, the sun, and semen, while femaleness is associated with procreation, digging sticks, coolness, the moon, and menstrual blood. These dichotomies are intertwined completely within their cultural belief systems, such that menstruating women, who are at their most powerful, are not allowed to touch men's poison arrows for fear of "cooling" their hot potency and rendering them useless. On the other hand, male identity is based on hunting aptitude and the ability to obtain and keep a wife was dependent on hunting skill. Boys at puberty had to prove their worth as hunters and a man who did not kill a large meat animal would never attract a wife (Biesele 1993). A trap like that discussed above requires a large number of people to ensure a successful hunt (Biggar 1922-1936, Legge & Rowley-Conwy 1987). Thus, the presence of women was probably required in directing animals into the trap, where hunters waited in hiding (Biesele 1993, Biggar 1922-1936), and in processing the large number of carcasses after a high work input for the return achieved. This pattern usually indicates a need to exploit a wide range of resources because the population is reaching the carrying capacity of the region. A narrow diet breadth, identified by the presence of a few species, or a dominant species, indicates efficient hunting practices, without population pressures. Thus, if an archaeological site is dominated by low ranked species, one may incorrectly infer that the site exhibits evidence for a wide diet breath because of the ranking of the prey, when in fact the site reflects a narrow diet breadth strategy, focussing on the abundance of a single species.

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Most cultures reserve the active procurement of meat from large animals as a male activity. While it is common for women to snare small animals and collect shellfish and tortoises, these activities are done with children present and even with their assistance. Ethnographic records of mass harvesting generally show that both men and women were involved, from the Huron in Canada (Biggar 1922-1936) and eastern Great Basin populations in Utah (Madsen & Kirkman 1988) to the /Xam San of South Africa (Bleek & Lloyd 1911).

Why were women allowed to be involved with the trapping of springbok and is there any other evidence to suggest the presence of women at springbok hunts?

The important behavioural difference between springbok and the other bovid species in the Namaqualand region is that springbok are the only bovids that congregate in large herds. Thus, they are the only species that during certain times of the year can be hunted *en masse,* necessitating the assistance of everyone in the group, including women, to trap and/or process large numbers of carcasses. In addition, there were many taboos amongst the /Xam (Lewis-Williams & Dowson 1999) with regards to the treatment of springbok meat, bones, and skins. For example: women were not allowed to eat the meat from the shoulder blade, the bone through which the heart is pierced, in order to show respect for the men's arrows (Bleek & Lloyd 1911). This taboo is also practical if poison was being used. According to the /Xam, springbok, like shamans, possess "invisible magic arrows" (Bleek & Lloyd 1911, Lewis-Williams & Dowson 1989), which kill people if they do not treat the bones of springbok in the manner required or if they allow young children to play on springbok skins. It seems that if there was a windfall of a food item that required many people to procure, everyone, including women, was involved, even if this required some re-conceptualization of the usual cultural taboos.

Following a mass harvest, two options become available for the excess: storage or sharing beyond the group. The storage of food items requires a compatible climate, for example, Inuit from the Arctic region are able to store caribou meat for up to a year due to permafrost, which acts as a natural freezer. Thus, the economic strategy of mass harvesting and subsequently storage can provide for food for nearly a year (Burch 1972). In contrast, people who live in regions that are not compatible with long-term storage of meat, such as tropical climates, must rely on sharing. While sharing in egalitarian societies has been interpreted successful hunt. Of course there could have been exceptions, such as a hunting party of men, arranged well in advance of the event.

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In a mass harvesting situation, the abundance of food could have allowed primary sharing partners to receive large meat parcels that could then have been subdivided and shared with other sharing partners at potentially long distances. The sharing of large amounts of meat also allows individuals who are not usually part of the primary sharing network (such as the elderly) to participate (Kent 1993). Thus, it is possible that many people would receive proceeds of mass harvesting, even if they were many kilometres away when it was originally collected.

In Namaqualand, mass harvesting springbok is likely to have been an occasional supplement to a broader subsistence base, rather than a key strategy as mass harvesting of caribou, for example, is among some Inuit groups (Burch 1972). If the caribou take a different route and do not arrive, the Inuit run the risk of starving and must rely on family with abundance to take them in (Burch 1972). This is a very different situation from the people of the Namaqualand coast, whose primary subsistence base, as reflected in numerous archaeological sites in the region, was shellfish and other marine species (personal observation). Here, a mass harvest of springbok was probably an occasional windfall and as such, its importance may have lain primarily in the social realm.

Chapter Six: KV502

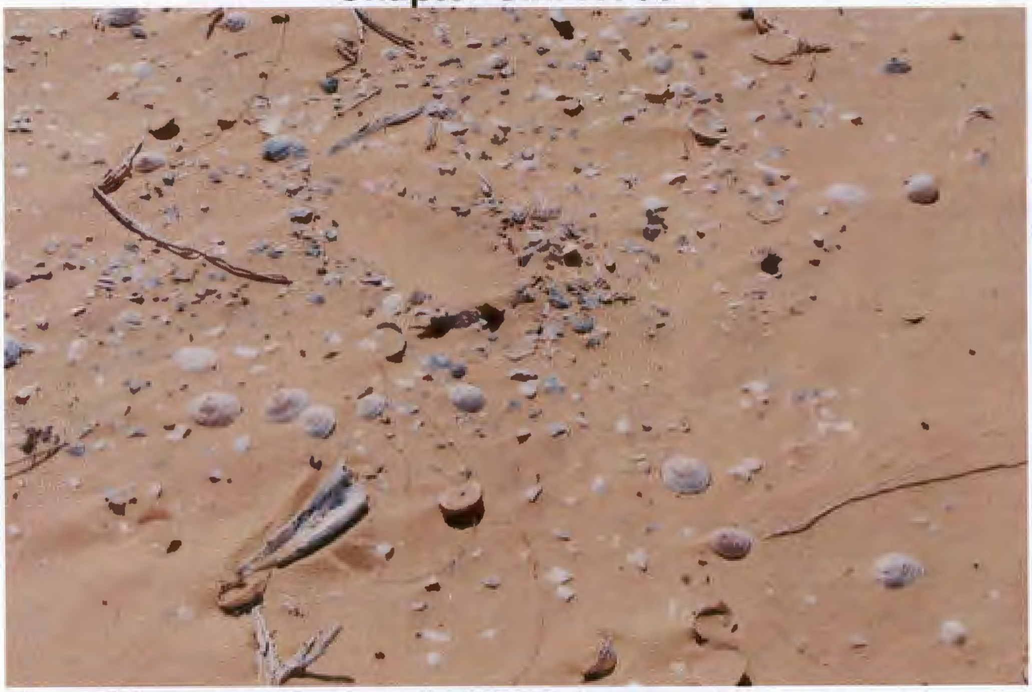


Figure 6.1 Close up of the surface of KV502 before excavation

Introduction

KV502 is a small open-air site amongst a cluster of shell middens within a deflation hollow contained by a complex of red dunes and deflated areas, roughly 6km east of the Atlantic Ocean (29° 30' 03.0" S, 17° 03' 18.8"E). This inland site is northeast of the Kareedoringsvlei saltpan, within the Buffels Marine Complex (BMC) of the DeBeers Namaqualand mine, 18 km northeast of the Buffels River and the town Kleinsee, Northern Cape, South Africa (Fig. 1.5).

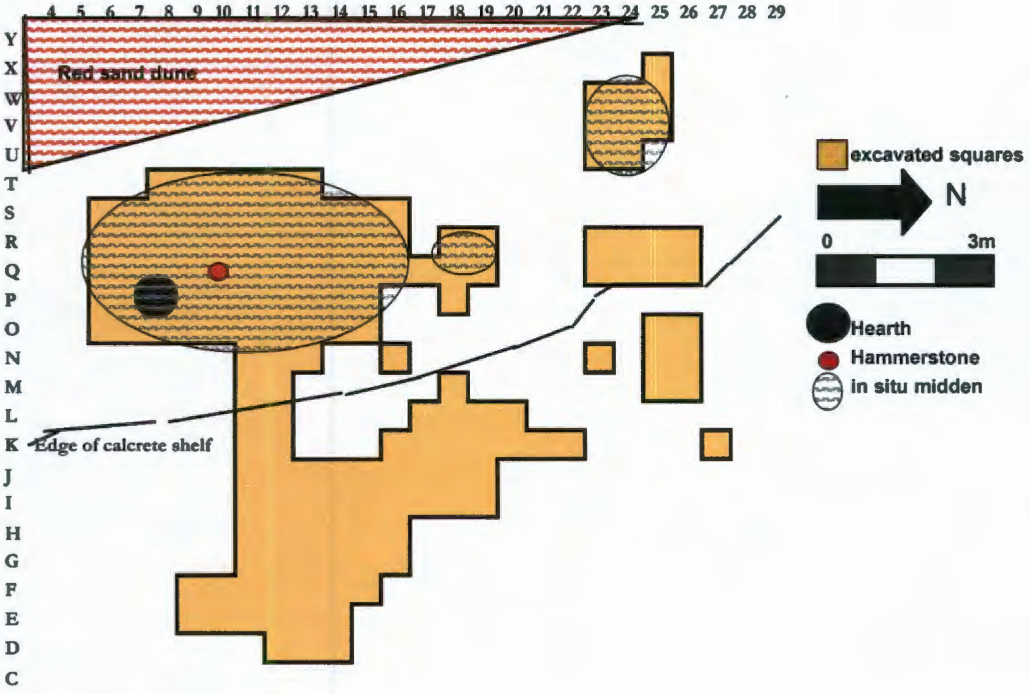
The Archaeology Contracts Office identified KV502 in 2002 during the archaeological assessment of the BMC (Halkett 2003). A hearth was identified along a raised calcrete shelf, situated beneath a red dune and associated with a scatter of shellfish and cryptocrystalline silicate (CCS) stone artefacts. A substantial quantity of shellfish had deflated out of the site due east of the hearth (Fig. 6.2). The site was immediately considered to be of interest due to the presence of microlithic CCS thumbnail scrapers.

Excavation

The site was excavated in 50 cm^2 units, using trowels, pans, buckets, a 3mm and a 1.5mm sieve. In total, 33.75 m^2 was excavated which constituted roughly 70% of the site. There is a single occupation layer ranging in thickness from 3-30 cm in depth. Unfortunately, bucket counts were not recorded so the volume of sediment removed cannot be determined (Halkett 2003).

There are three in situ shell middens. The largest patch at the south end of the site is 5.5m long. The central patch is small at 1m in length and the northwest patch is roughly 2m in diameter (Fig. 6.2). The eastern section of the site is within a deflation corridor where shell and other archaeological material has eroded out.

Figure 6.2 **Plan of KV502**



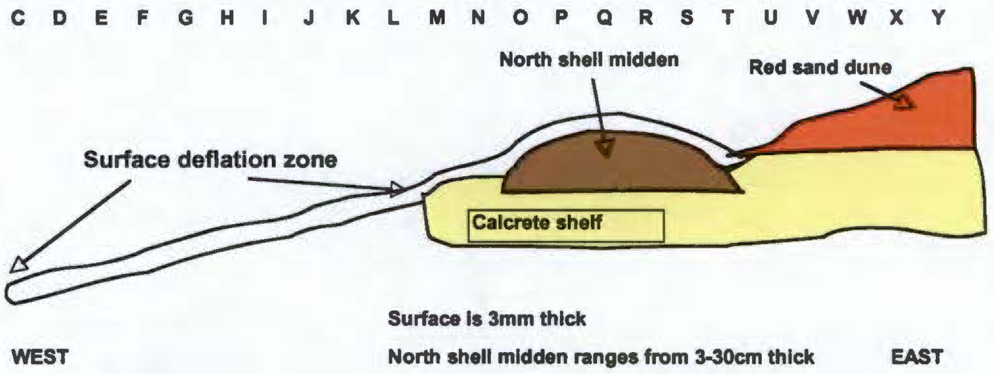
Features

There is a single hearth located at the southwest end of the excavation (Fig 6.2). The hearth is 1m in diameter and consists of small pieces of charcoal, primarily on the surface. However, there is a dense concentration of burnt bone 5cm thick surrounding the hearth and the soil is dark and ashy for 30 cm.

Radiocarbon dating

A single radiocarbon date was obtained for the site on marine shell. The radiocarbon date is 2940±45 yrs BP (Pta-9306), with a calibrated radiocarbon date of 536BC (690-475 BC).

Figure 6.3 **Schematic profile of KV502, through the intersection of rows 11 and 12**



Spatial distribution of archaeological material

The archaeological remains present at the site include lithics, ostrich eggshell, bone, crayfish, and marine shellfish. The lithics were distributed across the site and concentrated in two areas, across the deflated area and in the northwest shell midden, however there is also a small cluster of lithics in the large midden (Fig. 6.3). The ostrich eggshell was scattered across the site with a slight concentration at the east end of the deflation zone (Fig. 6.4). Bone was found throughout the site but was concentrated around the hearth in the large midden as well as a small cluster in the northwestern shell patch (Fig. 6.5). The crayfish were scattered across the site, but were most densely concentrated in the northwest patch and in the deflation zone (Fig. 6.6). As the shellfish was sub-sampled, there is no data regarding the spatial distribution of shell, except for the plan of the shell middens (Fig. 6.2). Overall therefore, the majority of the archaeological material was found scattered across the deflation zone, but the bone is focussed in the large midden. There is no evidence for separate activity areas defined by sexual divisions of labour.

Figure 6.4 The spatial distribution of lithics at KV502. The values are lithics per square. Blue highlights areas of dense concentration of material with values greater than nine lithics per square

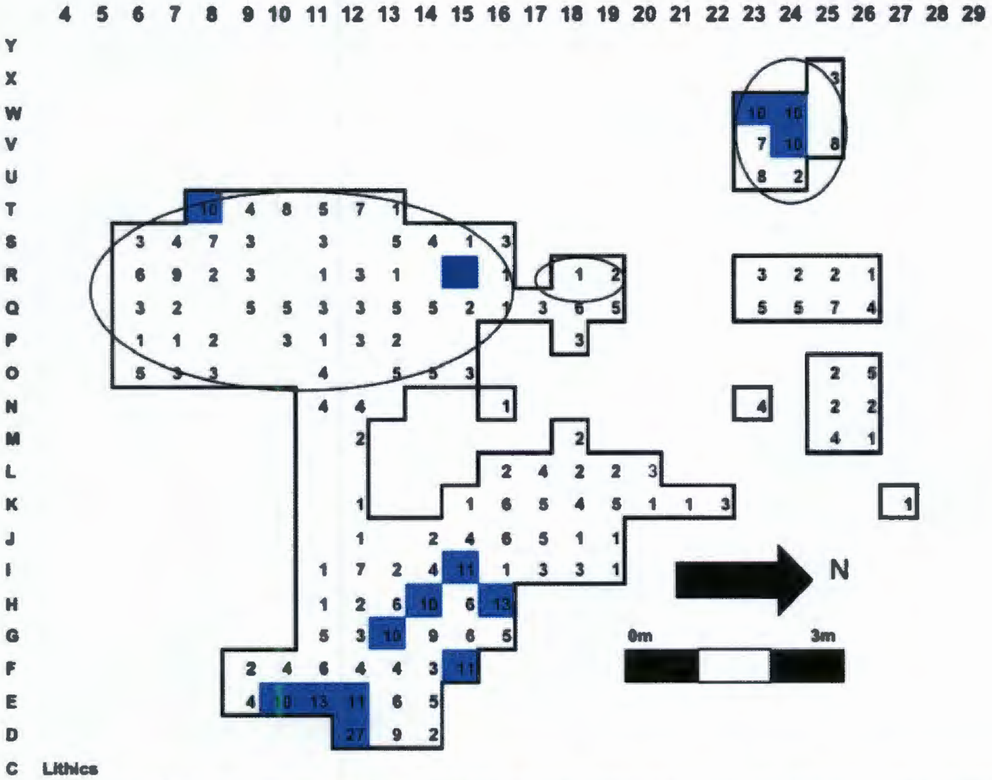


Figure 6.5 The spatial distribution of ostrich eggshell at KV502. The values are number of fragments per square. Orange highlights dense concentrations with values greater than one piece per square

Figure 6.6 The spatial distribution of bone at KV502. Values are numbers of bone per square. Green highlights the areas of dense concentrations with values greater than 15 bones per square

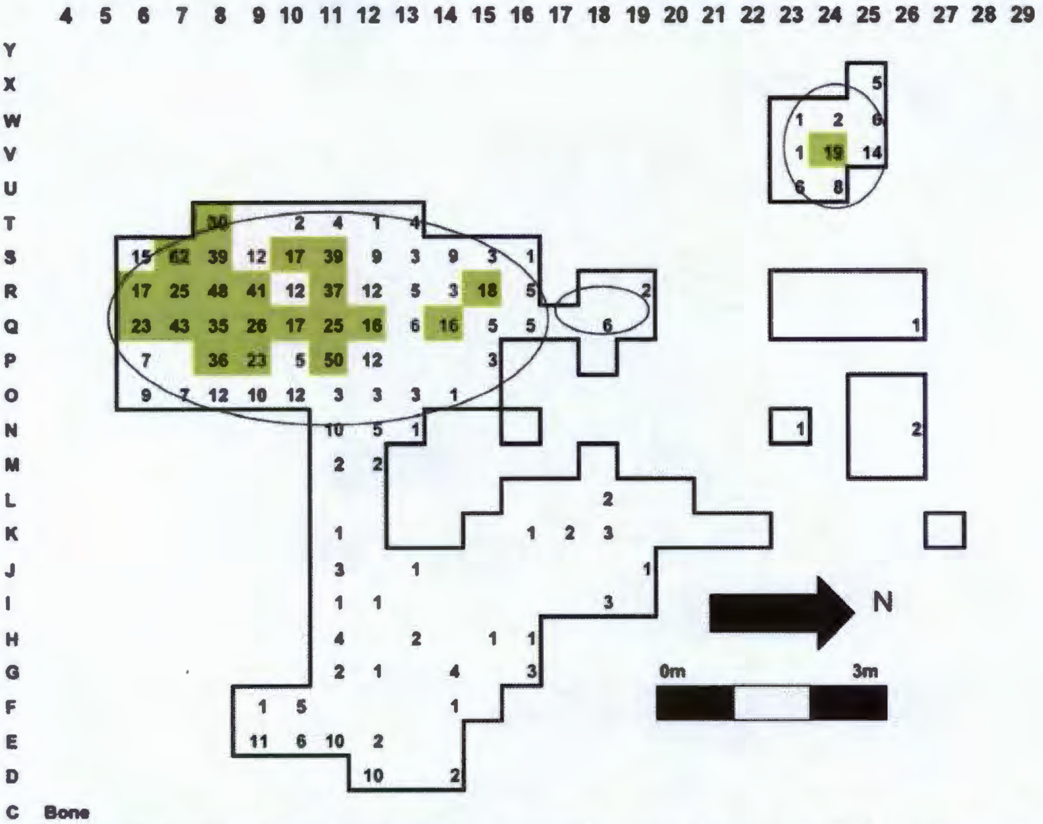
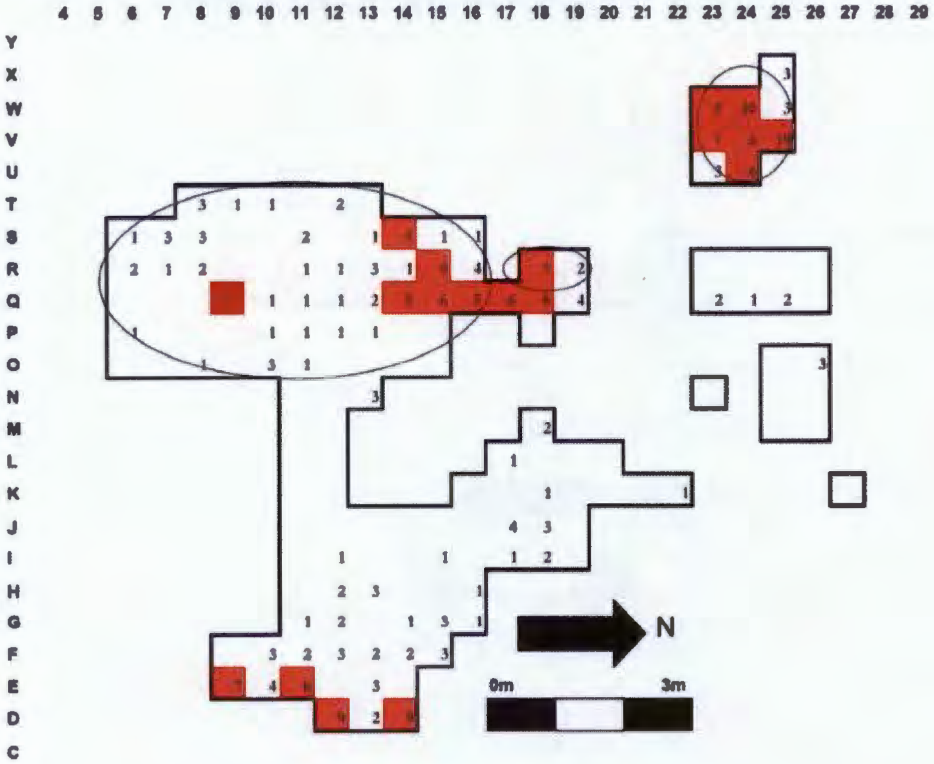


Figure 6.7 The spatial distribution of crayfish mandibles at KV502. Values are numbers of mandibles per square. Red highlights the areas of dense concentrations with values greater than four mandibles per square



Lithics

The lithic assemblage, identified by Jayson Orton, consists of 615 stone artefacts. The stone is dominated by milky quartz at 73.2% of the assemblage, followed by cryptocrystalline silicate (CCS), silcrete, sandstone, quartzite, and ochre (Table 6.1). There are 32 formal tools that account for 5.2% of the stone assemblage dominated by CCS (62.5%). The CCS tools consist of a range of scraper forms (Table 6.2), including thumbnail scrapers, side scrapers, backed scrapers, as well as a backed bladelet (Fig. 6.8). The milky quartz tools consist of miscellaneous backed pieces and miscellaneous retouched pieces, while the quartz crystal formal tool is a backed bladelet. Silcrete tools are more consistent with the CCS tools: scrapers and miscellaneous retouched pieces (Tables 6.2& 6.3).

Table 6.1 **Lithic raw materials at KV502**

Stone	No.	%No.
Milky quartz	419	68.1
CCS	88	14.3
Fine silcrete	33	5.4
Quartz crystal	30	5.0
Coarse silcrete	23	3.8
Ochre	12	2.0
Sandstone	6	1.0
Quartzite	3	0.5
Total	**615**	**100**

Figure 6.8 **Some lithics from KV502. Top row are two CCS thumbnail scrapers, middle row are two CCS backed scrapers with a quartz crystal backed bladelet in the middle. Bottom row are three CCS side scrapers.**

Table 6.2 **The fine-grained material lithic assemblage at KV502**

Stone	No.	%No.
Milky quartz		
Miscellaneous backed piece	2	0.3
Miscellaneous retouched piece	3	0.5
Formals sub total	**5**	**0.8**
Blade	1	0.2
Bladelet	4	0.7
Flake	155	25.2
Chunk	62	10.1
Chip	168	27.3
Debitage sub total	**390**	**63.4**
Edge damaged flake	9	1.5
Edge damaged chunk	1	0.2
Edge damaged sub total	**10**	**1.6**
Bipolar core	5	0.8
Irregular core	8	1.3
Cores sub total	**13**	**2.1**
Manuport	**2**	**0.3**
CCS		
Thumbnail scraper	2	0.3
Sidescraper	10	1.6
Backed scraper	4	0.7
Backed bladelet	1	0.2
Miscellaneous retouched piece	3	0.5
Formals sub total	**20**	**3.3**
Blade	1	0.2
Flake	26	4.2
Chunk	7	1.1
Chip	24	3.9
Debitage sub total	**58**	**9.4**
Edge damaged flake	1	0.2
Edge damaged chunk	1	0.2
Edge damaged sub total	**2**	**0.2**
Irregular core	1	0.2
Bipolar core	5	0.8
Single platform core	2	0.3
Cores sub total	**8**	**1.3**
Fine silcrete		
Sidescraper	2	0.4
Miscellaneous retouched piece	3	0.5
Formals sub total	**5**	**0.8**
Blade	9	1.5
Bladelet	4	0.7
Flake	12	2.0
Chunk	1	0.2
Chip	1	0.2
Debitage sub total	**27**	**4.4**
Bipolar core	1	0.2
Core sub total	**1**	**0.2**
Quartz crystal		
Backed bladelet	1	0.2
Formal sub total	**1**	**0.2**
Bladelet	1	0.2
Flake	10	1.6
Chunk	7	1.1
Chip	11	1.8
Debitage sub total	**29**	**4.7**

Debitage accounts for 85.7% of the assemblage and consists of blades, flakes, chips, and chunks on all raw materials and bladelets in milky quartz, quartz crystal, and fine silcrete. Cores at the site include irregular, single platform, and bipolar forms that account for 3.7% of the assemblage. Milky quartz is dominated by irregular cores followed by bipolar cores, while bipolar cores, followed by single platform and then irregular cores dominate the CCS category. There is a single bipolar core on the fine-grained silcrete and an irregular core on the coarse-grained silcrete. There are edge-damaged flakes and chunks on both milky quartz and CCS as well as an edge-damaged flake on the coarse-grained silcrete, accounting for 2.1% of the lithics. There is a quartzite hammerstone and a lower grindstone as well as a lower and upper grindstone made on sandstone (Table 6.3). There are also twelve fragments of soft maroon ochre.

Milky quartz, quartzite and both silcrete forms are common in the region and locally available. Sandstone is an unusual raw material for stone artefacts, however it was also present at the Later Stone Age site of SK400, 18 km to the south, which has a local outcrop of quartz-rich sandstone. The source of the CCS and ochre is unknown, but as the site is sitting on a bed of floating calcrete, the CCS is also most likely local from the immediate vicinity.

Table 6.3 The coarse-grained material lithics at KV502

Stone	No.	%No.
Coarse Silcrete		
Miscellaneous retouched piece	1	0.2
Formal sub total	**1**	**0.2**
Flake	17	2.8
Chunk	1	0.2
Chip	1	0.2
Debitage sub total	**19**	**3.1**
Edge damaged flake	1	0.2
Edge damaged sub total	**1**	**0.2**
Irregular core	1	0.2
Core sub total	**1**	**0.2**
Manuport	**1**	**0.2**
Sandstone		
Flake	1	0.2
Chunk	2	0.3
Debitage sub total	**3**	**0.5**
Lower grindstone	1	0.2
Upper grindstone fragment	1	0.2
Grindstone sub total	**2**	**0.3**
Manuport	**1**	**0.2**
Quartzite		
Flake	1	0.2
Debitage sub total	**1**	**0.2**
Lower grindstone	1	0.2
Hammerstone	1	0.2
Hammerstone/grindstone sub total	**2**	**0.3**
Ochre	12	2.0

The presence of debitage and a hammerstone suggest that lithic processing activities occurred at this site. The presence of both upper and lower grindstones suggests grinding activities also occurred at KV502, although there is no evidence for what was being ground for even the ochre lacks evidence of utilisation.

Ostrich Eggshell

The ostrich eggshell assemblage consists of 31 fragments weighing 20.5 g. There are no ostrich eggshell beads.

Bone

Subsistence Strategy

The faunal sample consists of 1,036 bones that were identified to lowest possible taxon (Table 6.4). The breakage of the long bones was characterized following the four categories developed by Andrews (1990): complete, proximal, shaft, and distal. An Olympus light microscope (x4-x40) was used to examine the surface of the bones.

Table 6.4 The identified vertebrate species at KV502

Taxon		NISP	MNI
Canis sp.		8	1
Bovid size class II		11	1
Springhare	*Pedetes capensis*	23	2
Small mammal		90	1
Medium mammal		17	1
Medium-large mammal		3	1
Cape rock elephant shrew	*Elephantulus edwardii*	1	1
Striped field mouse	*Rhabdomys pumilio*	33	18
Brant's whistling rat	*Parotomys brantsii*	4	2
Karoo bush rat	*Otomys unisulcatus*	6	2
Rat sp.	*Otomys/Parotomys*	11	4
Hairy-footed gerbil	*Gerbillurus paeba*	1	1
Micromammal sp.		540	41
Aves		2	1
Fish		1	1
Angulate tortoise	*Chersina angulata*	269	2
Lizard		3	1
Medium snake		14	1
Total		**1037**	**88**

Micromammal species were identified by Margaret Avery

As 78.4% of the faunal assemblage consisted of micromammals, Margaret Avery from the Iziko Museum of South Africa identified the micromammal sample while I identified the remaining fauna. The macro-fauna are represented by foreleg bones from a *Canis* species, probably black backed jackal; a few long bone shaft fragments from a small mammal, a medium mammal, and a medium-large mammal; a few fragmented teeth from a springbok or grey duiker; a vertebra from a snake, a vertebra from a fish; a lizard mandible and vertebrae; fragments of long bones from a bird; and the highly fragmented and burnt carapace of two angulate tortoises. The majority of the faunal sample are micromammal remains, represented by five species: Cape rock elephant shrew (*Elephantulus edwardii)*, striped field mouse (*Rhabdomys pumilio)*, Brant's whistling rat (*Parotomys brantsii)*, Karoo bush rat (*Otomys unisulcatus)*, and hairy-footed gerbil (*Gerbillurus paeba)*. There are also numerous elements from unidentified rats and or mice within the Muriad family. As micromammals dominate the assemblage, the faunal analysis will focus on them.

Element distribution and breakage: Skulls

The most noticeable pattern at KV502 is the overwhelming dominance of crania and the high frequency of isolated incisors (Fig. 6.9). The sample is fragmented with 61.4% of the micromammal bone identifiable to element with the remaining bone consisting of unidentifiable fragments. The average relative abundance for the crania is 44.3%. This value is low, as the MNI was based on isolated incisors, however, the average relative abundance was biased by the low frequency of isolated molars. The skulls have been extensively damaged as there are only 6 fragments of cranial bone. The maxillae and mandibles are also heavily damaged: none of the maxillae are complete, only 47.6% have the zygomatic arch attached, and the majority are missing molars and incisors (Table 6.5). In the case of the more robust mandibles, 88.9% are incomplete while 74.8% of the molars are missing as well as 44.4% of the incisors. A small percentage of teeth are broken (Table 6.5) but isolated teeth escaped damage.

Figure 6.9 **The relative abundance of the skeletal elements of micromammals at KV502. The MNI (100%)=45 based on incisors, is the value used to derive the relative abundance. Note the overwhelming dominance of crania**

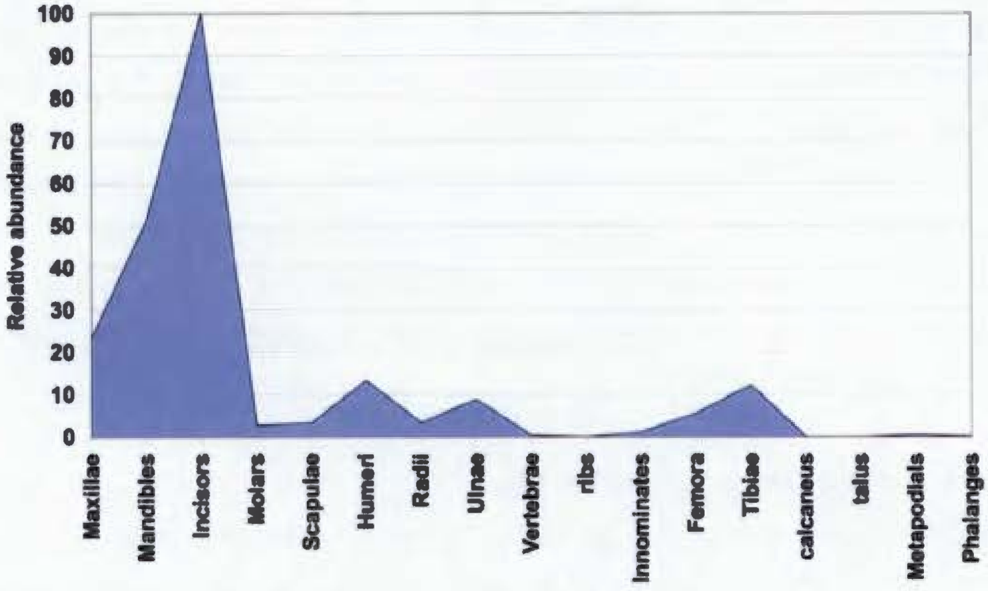


Table 6.5 **Breakage of cranial/ dental elements of micromammals at KV502**

Total maxillae (N)	21
% complete	0
% maxillae with zygomatic	47.6
Molars missing from maxillae	77.8
% incisors missing from maxillae	95.2
Total mandibles (N)	45
% complete	11.1
% inferior broken	22.2
% molars missing from mandibles	74.8
% incisors missing from mandibles	44.4
Breakage of Teeth	
% molars broken "in situ"	21.4
% isolated molars broken	0
% incisors broken "in situ"	8.3
% isolated incisors broken	0
% total molars broken	4.6
% total incisors broken	0.9

There are 15 isolated molars and 150 empty alveolar sockets, suggesting that teeth are missing from the sample. There are 181 isolated incisors with 40 empty alveolar sockets suggesting that jaws are missing. Thus, both teeth and jaws are damaged and or missing from the sample.

Element distribution and breakage: Post-crania

The relative abundance of post-crania is low at 3.7%. The majority of elements were below 10% relative abundance with the exception of tibiae and humeri at 12.2% and 13.3% respectively. There were no ribs or tarsals and very few phalanges or metapodials. The sample consists entirely of adult animals as the epiphyses of all elements were fused.

Breakage patterns of the four major long bones are presented in Table 6.6. Limb bones are uncommon in the sample, but of these that are present, a high percentage are complete. There are also distal humeri, proximal ulnae, proximal and distal femora and tibiae. The ratio of distal limbs to proximal limbs is 0.82, suggesting that there is very little difference in the preservation of long bones based on anatomical position (Table 6.7).

In sum, the micromammal sample at KV502 is dominated by cranial elements, specifically mandibles and isolated incisors. The ratio of post-crania to crania is 0.15 including the isolated teeth, and 0.26 when they are excluded. This reveals a striking dominance of cranial elements in the assemblage. The majority of the post-crania are complete, and when broken are dominated by the robust ends, yet fragile ends such as the distal tibia are also present. Heavy damage to the maxillae, a large number of isolated teeth, and the lack of small foot bones may be evidence for trampling (Andrews & Evans 1983).

Table 6.6 Post-cranial breakage of micromammals at KV502 and GRM5

Elements	**KV502**		**GRM5**	
Humerus	**No.**	**%No.**	**No.**	**%No.**
Complete	4	33.3	0	0
Proximal	0	0	2	33.3
Shafts	0	0	0	0
Distal	8	66.6	4	66.6
Ulna				
Complete	4	50	0	0
Proximal	4	50	1	100
Distal	0	0	0	0
Femur				
Complete	2	40	0	0
Proximal	2	40	2	66.6
Shafts	0	0	0	0
Distal	1	20	1	33.3
Tibia				
Complete	7	63.6	0	0
Shafts	0	0	1	33.3
Proximal	2	18.2	1	33.3
Distal	2	18.2	1	33.3

Table 6.7 **Various indices comparing KV502 with GRM5. Postcrania/crania is (femur+ humerus+ radius+ ulna+ tibiae /maxillae+ mandibles+ isolated teeth). Femora+ humeri/mandibles+ maxillae is a second index to identify the importance of isolated teeth on the results of the index. Tibia+ radius /femur+ humerus identifies the loss of distal limb elements, while %isolated molars and %isolated incisors are measures of observed isolated teeth/ observed empty alveolar spaces (Fernandez-Jalvo 1995). A measure greater than 1 suggests the destruction of jaws while less than 1 suggests missing teeth**

Index	KV502	GRM5
Postcrania/crania	0.15	
Femur+ humerus/mandible+ maxilla	0.26	
Tibia+ radius /femur+ humerus	0.82	0.44
%Isolated molars (15molars, 150 empty sockets)	0.10	
%Isolated incisors (181incisors, 40 empty sockets)	4.53	

Digestion

There is no acid etching found on any of the crania or dentition. Three post-cranial specimens (a total of 0.6% of bones) exhibit light acid etching along the epiphyseal fusion line (Table 6.8).

When micromammals are found within archaeological assemblages, their presence is usually attributed to one of two processes: they are intrusive into the deposit because of their burrowing behaviour; or they were deposited by a predator: raptors, diurnal birds of prey, or small carnivores.

Table 6.8 **Stages of digestion of the micromammal remains from KV502 and GRM5**

	Digestion	GRM5 Stomach N=55	GRM5 Intestines N=49	KV502 N=528
No acid etching	No corrosion	0	0	525/99.4%
Light acid etching	Corrosion along epiphyseal line only	13/23.6%	17/34.7%	3/0.6%
Moderate acid etching	Moderate corrosion of cancellous bone	27/49%	10/20.4%	0
Heavy acid etching	Heavy corrosion of cancellous bone	0	5/10.2	0
	Rounding of broken edges	18/32.7%	20/40.8%	0
	Corrosion of the surface of cortical bone	3/5.5%	6/12.2%	0

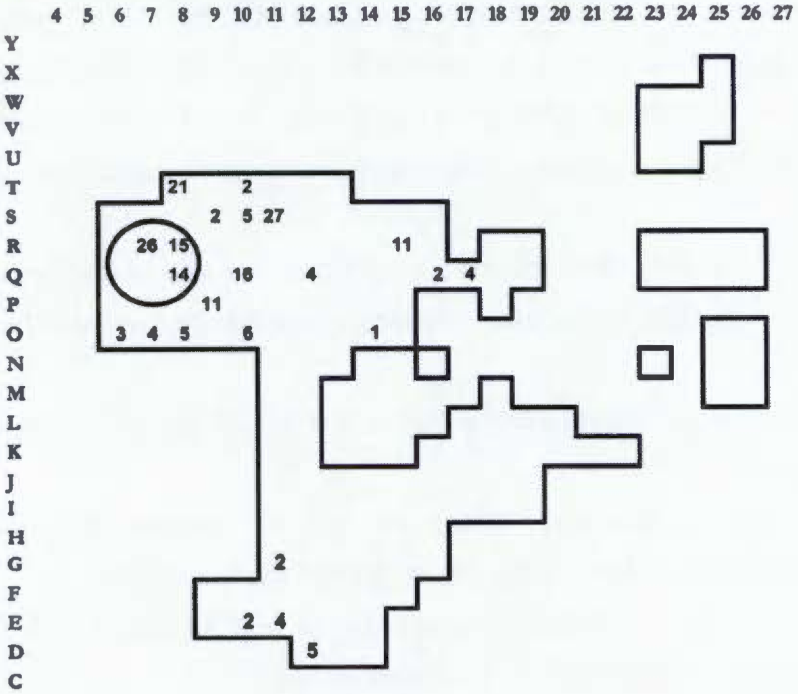
Micromammal specialists have been studying pellets and scats of modern predators, identifying specific patterns in the remains of their prey (Andrews

1990, Andrews & Evans 1983, Denys *et al.* 1995, Fernandez-Jalvo 1995, Matthews 2002). These studies were conducted in order to identify predators and their corresponding subsistence strategies in order to account for potential biases when using micromammals to determine the palaeoecology of a site. However, the KV502 assemblage does not fit into any of these pre determined patterns, in fact, I suggest that humans are consuming the micromammals at KV502 (Dewar & Jerardino 2007) and should be condsidered a category 5 predator following Andrews (1990) classification:

Category 1: light modification includes the barn owl, snowy owl, and gyrfalcon
Category 2: intermediate modification includes various eagle owls and the tawny owl.
Category 3: moderate modification includes kestrel, peregrine, osprey and some eagles.
Category 4: great modification includes the common buzzard, vulture, bat-eared fox, white tailed-mongoose, and small-spotted genet.
Category 5: extreme modification includes coyote, red fox, otter, and some felids (see Andrews 1990 for a full species list).

At KV502 the micromammal bone is located near the hearth (Fig. 6.10) and 8% of the fragments recovered are charred. Unfortunately, there is only one experimental paper (Crandall & Stahl 1995) that identifies patterns diagnostic of human consumption of micromammals, even though there is ethnographic evidence for such behaviour (Lee 1979, Lupo & Schmitt 2005, Silberbauer 1981). A human burial excavated at the Groen River Mouth, Namaqualand, about 150 km south of KV502 yielded micromammal bones from the stomach cavity (Jerardino *et al.* 1992). These provided a useful comparison with the remains recovered from KV502. While the sample size is small, only one camp site and one human burial, this is a starting place to build a model that enables one to identify micromammal remains left by humans, from both the stomach contents and the complementary refuse site of KV502.

Figure 6.10 **The spatial distribution of micromammal remains at KV502. Note the close proximity of the bones to the hearth**



GRM5

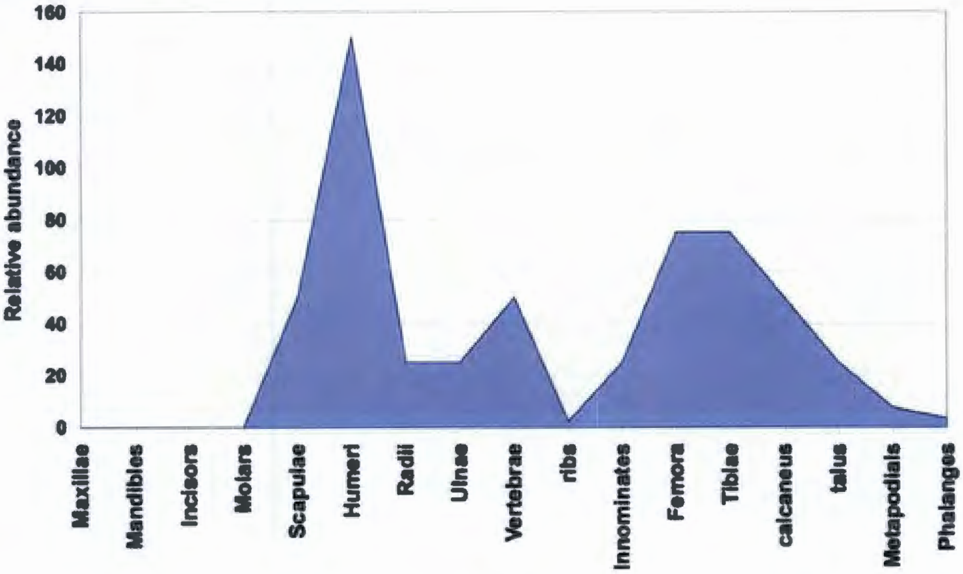
Groen River Mouth 5 is a shell midden in a large dune deflation bay on the north bank of the Groen River Mouth, Northern Cape, South Africa (30.50S, 17.35E) (Fig. 1.5). The human burial (UCT#445) is that of a 40+ year old female that was found eroding from beneath a pile of water worn rocks adjacent to the midden. GRM 5 burial was excavated and the surrounding sediment sieved through a 2 mm mesh to ensure the recovery of the smallest material. Of note were the micromammal remains recovered from the lower thorax and pelvis. Analyses of the human remains are published in Jerardino *et al.* (1992). Collagen from the ribs yielded a radiocarbon date of 2720±60 BP (Pta-5617) and a calibrated radiocarbon date of 205BC (362-47BC).

The stomach contents from the GRM 5 burial consisted entirely of micromammals with 104 bone fragments from the genus *Parotomys* (Jerardino *et al.* 1992). Identification to species level was impossible due to the lack of cranial remains. There is an MNI of two individuals based on distal humeri.

Element distribution and breakage

The most noticeable pattern in the distribution of elements is the complete absence of cranial remains and dentition (Fig. 6.11). Evidently, micromammals were decapitated prior to consumption, and the skulls were discarded, otherwise at least a fragment of a robust element such as a molar would likely have been found. The postcrania are heavily fragmented with only 57.8% of the assemblage identifiable to element and no complete long bones. The remaining bone consisted of rounded chunks and fragments of unidentifiable long bone shafts.

Figure 6.11 **The element distribution of micromammal remains from the GRM 5 burial. The MNI (100%)=2 based on humeri, is the value used to derive relative abundance. Note the lack of skull elements**



The average relative abundance is 43.3% although this value is biased by the low values for ribs, metapodials, and phalanges. These elements are fragile and were most likely damaged during consumption and probably constitute many of the unidentified fragments. The *Parotomys* remains are immature as primary fusion of the epiphyses of the distal humeri and proximal femora has occurred, but the fusion of the secondary epiphyses (the proximal humeri and tibiae) has not. As expected, the robust fused ends were preferentially preserved, namely the proximal femora, proximal ulnae, and distal humeri

(Table 6.6). The lack of complete long bones is most likely due to their fragmentation during mastication as 4.8% of the sample exhibited surficial crushing.

There also seems to be preferential preservation of the proximal limb bones over the distal limb bones. While the tibiae and radii are present in the sample, they are only 0.44 times as abundant as the femora and humeri (Table 6.7). The proximal limbs also have the most robust ends, so this proximal/distal limb ratio may be a function of the robusticity of the epiphyses and not the location of the bone in the body.

Digestion and damage categories

Damage to bone due to mastication is clear, but acid etching from passing through the digestive system has also affected the sample (Table 6.8). The level of digestion varied and was categorised into four groups.

No acid etching:
Light acid etching: corrosion along the epiphyseal line
Moderate acid etching: moderate corrosion of cancellous bone
Heavy acid etching: heavy corrosion of cancellous bone, rounding of broken edges, and or corrosion that extends onto the surface of cortical bone.

Bone was retrieved from two areas of the GRM 5 burial, the stomach, and the intestinal region. Overall, 38.2% of bone from the stomach showed acid etching, while 63.2% of bone retrieved from the intestinal region exhibited acid etching. Heavy etching was more common on bone from the intestines (Table 6.8 and Fig. 6.12). This pattern is to be expected as elements in the intestines have been exposed to gastric acids for a longer period of time. Of note is the presence of rounding of broken edges and corrosion on the surface of cortical bone. These are extreme levels of acid etching and bone modification.

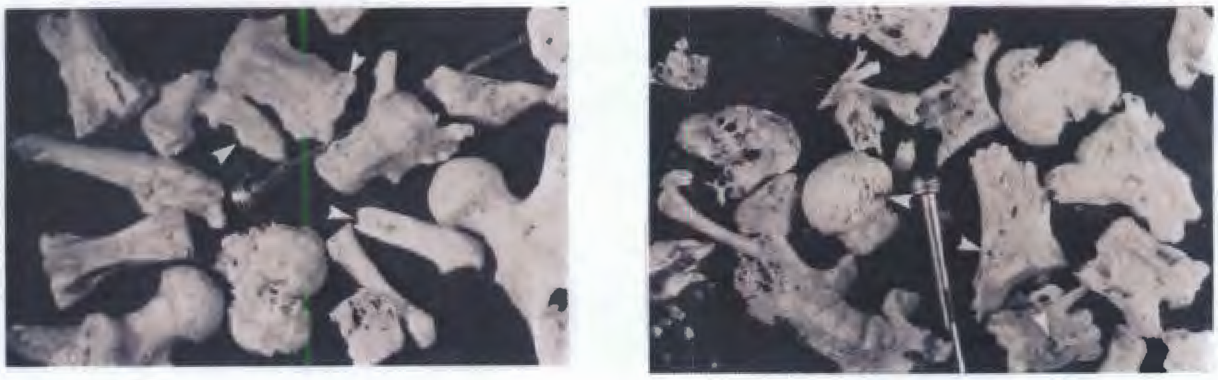


Figure 6.12 Micromammal remains from the GRM 5 burial. The image on the left shows the bones from the stomach area. Arrows show the rounding of bone edges. The image on the right shows bones from the pelvic area. Arrows show corrosion. Note the greater degree of acid etching and fragmentation of the bone from the pelvic area, probably due to more prolonged exposure to digestive acids. The pin is included for scale. The images were originally published in Jerardino *et al.* (1992)

In sum, the pattern of human consumption of micromammals from the GRM 5 burial is: the lack of cranial elements; heavy fragmentation of the post-crania; a lack of complete long bones; preferential preservation of robust ends of long bones; preservation of proximal limbs over distal limbs; moderate to heavy corrosion of bone including the corrosion of cancellous bone, rounding of broken edges, and corrosion on the surface of bone. This is extreme modification to bone and thus humans should be considered a category 5 predator in terms of Andrews' (1990) classification.

The GRM 5 burial provides evidence of direct consumption of micromammals by humans. This sample can therefore be used as a comparative model. The lack of skull elements suggests that prey was decapitated before consumption. The lack of complete long bones and the presence of superficial crushing suggest fragmentation due to mastication. The low relative abundance of small fragile bones such as phalanges, carpals/tarsals, and ribs suggest that they were destroyed through mastication and/or digestion. There is evidence of extreme digestion with bone exhibiting rounding on broken edges, extreme corrosion of the epiphyses, and corrosion extending onto the surfaces of long bones. While the sample size is small, there is a pattern to the damaged bone and it places *H. sapiens* in category 5, extreme modification, following Andrews' (1990) classification system.

The complementary pattern to that seen in the GRM 5 burial would be an assemblage dominated by skulls with no evidence of digestion. Caution is required, because the decapitation of prey before consumption has also been attributed to carnivores such as black backed jackals (Matthews 2002), arctic fox, coyote, and white-tailed mongoose (Andrews & Evans 1983). Thus, the locations where these animals consumed their prey should also contain micromammal heads with no evidence of digestion. However, carnivores tend to capture individual prey by pouncing or chasing. This would lead to the deposition of individual skulls across space in a random fashion, not a pile of 45 individuals clustered together, as found at KV502. Finally, there is no evidence of carnivores affecting the bone sample; there are no carnivore gnawing or puncture marks on the bones of larger animals.

The micromammal sample from KV502 exhibits a pattern complementary to that seen at GRM 5: a dominance of skulls with acid etching on only 0.6% of the sample. Further evidence supports the identity of the predator as human. First of all, the bone assemblage was located around a hearth and some of the bone is burnt, suggesting roasting. Cultural material including retouched stone artefacts and an ostrich eggshell bead, is also present. Ethnographic research identified the use of traps to collect rodents (Lupo & Schmitt 2005), thereby allowing for the collection of many individuals.

The presence of prey from some other predator may be indicated by an assemblage of long bones bones with light digestion. Alternatively, the corroded bones could be the remains of human coprolites. However, this does not affect the best interpretation of the micromammal sample from KV502: that it derives from animals that were decapitated before being consumed by *H. sapiens.*

The identification of humans as the predator of micromammal assemblages is not a phenomenon found only in the arid coastline of Namaqualand. Reports from Later Stone Age sites in the Thukela Basin in Kwazulu Natal, South Africa also suggest that the micromammal remains were refuse of human consumption (Mazel 1989, Maggs & Ward 1980). Mazel (1989) used two factors to identify humans as the primary predator at Nkupe, Mgede, and Gehle shelters: the high density of micromammals, and the fact that the microfauna in the assemblage were all diurnal while potential predators in the region are nocturnal. Maggs & Ward (1980) used species composition and element frequencies to identify humans as the predators of moles at Driel

Shelter. Unfortunately, the element distribution and breakage patterns are not published. Nevertheless, the data from these four shelters suggests that people were consuming micromammals even in relatively rich environments throughout South Africa.

Thus, there are three points of interest. First, the development of a pattern that identifies the remains of micromammalian prey actually consumed by humans: a lack of any skull remains, heavy fragmentation of the long bones, evidence of crushing, and heavy corrosion on cancellous bone and broken edges. Second, the complementary pattern is documented in food waste discard at a camp site: a dominance of skulls, a high frequency of complete long bones, very little to no corrosion of bone, and a high MNI with burnt bone around a hearth. Finally, this study has identified *H. sapiens* as a category 5 predator, following Andrews (1990) classification and supports the experimental data published by Crandall & Stahl (1995). Selection by humans should be added to the list of potential sources of bias when using microfauna to determine palaeoenvironments.

Crayfish (Jasus lalandii)

There are a large number of crayfish mandibles at this site, considering it is 4 km from the coast. There are 266 individual specimens with an MNI of 135 based on right mandibles. The mean length of left mandibles is 11.1±2.3 mm with a range from 7.6-17.7mm. The mean length of right mandibles is 11.8±2.1 mm, with a range of 8.9-21.9mm. Following Jerardino *et al.* (2001) the derivation of mean carapace length is 78.1±11.5 mm with a range from 61.9-114.6mm based on right mandibles and 78.6±14.1mm with a range of 57.5-148mm based on left mandibles.

Shellfish

Due to the high number of shellfish, 1.75m^2 the site was sub-sampled in order to evaluate the species composition and average size. The identified shellfish sample is dominated *Scutellastra granularis* at 67.6% and *Cymbula granatina* at 16.9% of the assemblage (Table 6.9). Individuals were measured when possible and the *S. granularis* sample has a mean length of 38.1±4.8mm, while the *C. granatina* sample has a mean length of 51.4±5.2mm (Table 6.10).

Table 6.9 The shellfish species identified at KV502

Species	MNI	%assemblage
Scutellastra granularis	92	67.6
Cymbula granatina	23	16.9
Unidentifiable	21	15.4
Total	**136**	**100**

Table 6.10 The mean length and relevant statistics for the two species of shellfish at KV502

Species	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
S. granularis	10	38.1	4.8	23.8	53.7
C. granatina	55	51.4	5.2	43.5	58.6

Both *S. granularis* and *C. granatina* live within the mid inter-tidal zone on rocky shores that are only exposed during low tides, although *S. granularis* are known to move into areas that are exposed for a longer period. The lack of other species especially black mussel (*Choromytilus meridionalis*) suggests a short-term stay with a focused strategy on intertidal zone limpets. The absence of *S. argenvillei,* a limpet commonly found at archaeological sites in the region may point to the timing of the sites deposition as they are found in the low inter-tidal zone and prefer semi-vertical rocks, which are only exposed near or during spring low tides. Thus, it is possible that the shellfish was collected near a neap tide.

Kilojoules

The ratio of available kilojoules at KV502 is dominated by terrestrial species at 79% of the assemblage (Fig. 6.13). The largest contribution of kilojoules is from a bovid size class II at 35% of the assemblage (either a springbok or a grey duiker), followed by the micromammals at 16% and crayfish at 11% (Fig. 6.14 & Table 6.11). The shellfish provided 10% of the total diet.

Figure 6.13 The ratio of terrestrial and marine kilojoules at KV502

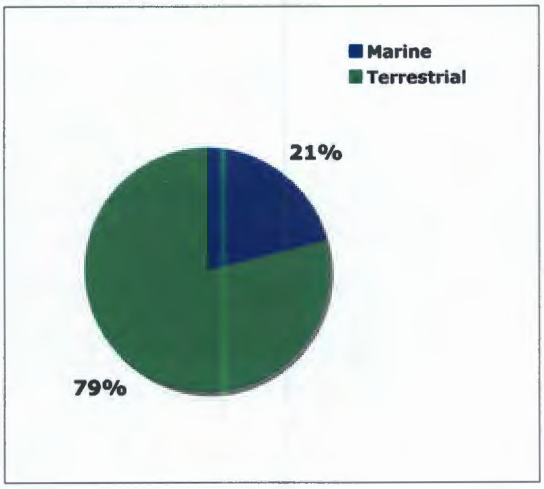


Figure 6.14 The distribution of kilojoules by species at KV502

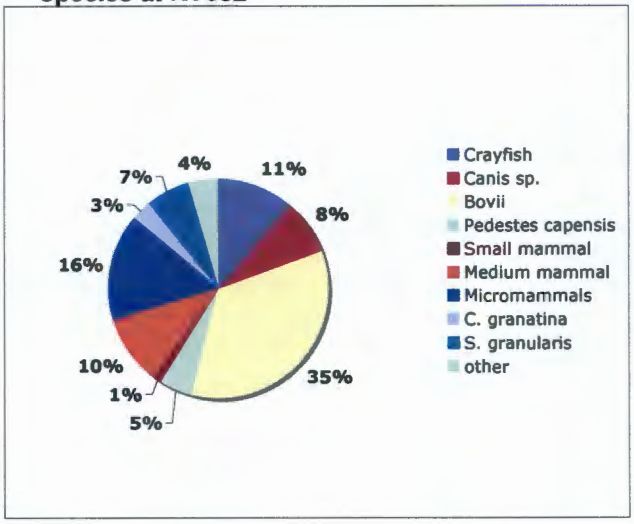


Table 6.11 The distribution of kilojoules at KV502. The values for various species are taken from Buchanan (1985)

Species	KJ/animal	Number of individuals	Total KJ
BovII	134,150	1	134,150
Canis sp.	31,500	1	31,500
Elephantulus edwardii	500	1	500
Rhabdomys pumilio	500	18	9,000
Parotomys brantsii	1,400	2	2,800
Otomys unisulcatus	1,400	2	2,800
Otomys/Parotomys	1,400	4	5,600
Gerbillurus paeba	500	1	500
Micromammal sp.	1,000	41	41,000
Small mammal	5,000	1	5,000
Medium mammal	40,000	1	40,000
Springhare	9,800	2	19,600
Aves	10,000	1	10,000
Fish	1,000	1	1,000
Angulate tortoise	2,000	2	4,000
Lizard	1,000	1	1,000
Medium snake	1,000	1	1,000
Crayfish	330.9	135	44,676.5
S. granularis	14.5	1,775	25,737.5
C. granatina	25.2	437	11,012.4

Discussion and conclusion

KV502 is 6kilometres inland from the Atlantic Ocean and 18km northeast of the Buffels River. The site is in a deflation hollow within a sand sheet, on top of a calcrete ridge. The shallowness of the deposit, and the low frequency of artefacts and shellfish, suggests a short-term occupation event in roughly

536BC. While a portion of the site has deflated out of its primary context, there are still two areas of dense concentration of materials, one surrounding the hearth and one seven meters northwest of the hearth. The lithic assemblage includes formal tools, debitage, edge damaged pieces, cores, and a hammerstone suggesting that tool making occurred at the site. The scrapers are made on a toffee coloured cryptocrystalline silicate and silcrete, while the bulk of the "waste" material and the backed tools was quartz. The majority of the stone is local, found within a 20km radius, however, the source of the ochre is at present unknown. The formal tools consist primarily of scrapers, and the presence of wide thumbnail scrapers and backed scrapers (otherwise known as a double segment) is particularly interesting. The only socially symbolic material identified at the site is the 12 pieces of maroon ochre, although they do not exhibit any evidence of having been used or ground.

The lack of finished ostrich eggshell beads is interesting as most Later Stone Age sites along this coast have at least a few (personal observation) perhaps this speaks to the short term duration of the occupation. The most abundant animals in the faunal sample are micromammals, typically a low ranked taxon. However, if low ranked species are mass harvested, this will elevate their rank by increasing cost-effectiveness (Chapter 5, Dewar *et al.* 2006). This is evident when analysing the available kilojoules at KV502, as the micromammals contribute more kilojoules than the crayfish and the entire midden of shellfish. The presence of micromammal skulls and the paucity of postcrania, along with the fragmentation and digestive patterns of the bone, suggests they were being eaten by humans rather than being intrusive in the deposit, or being deposited by raptors, or carnivores. Thus, humans should be introduced into Andrews scheme as a category 5 predator. There is no evidence at KV502 for people focussing hunting strategies on Cape fur seals from the rookery or African penguins from the hatchery. In fact, all the species present in this assemblage are easily collected or snared small meat packages. Although the presence of a few backed artefacts hints at the notion of hunting with a bow and arrow.

Chapter Seven: TP2004-04

Figure 7.1 **Facing northwest, TP2004-04 is just in front of Jayson Orton**

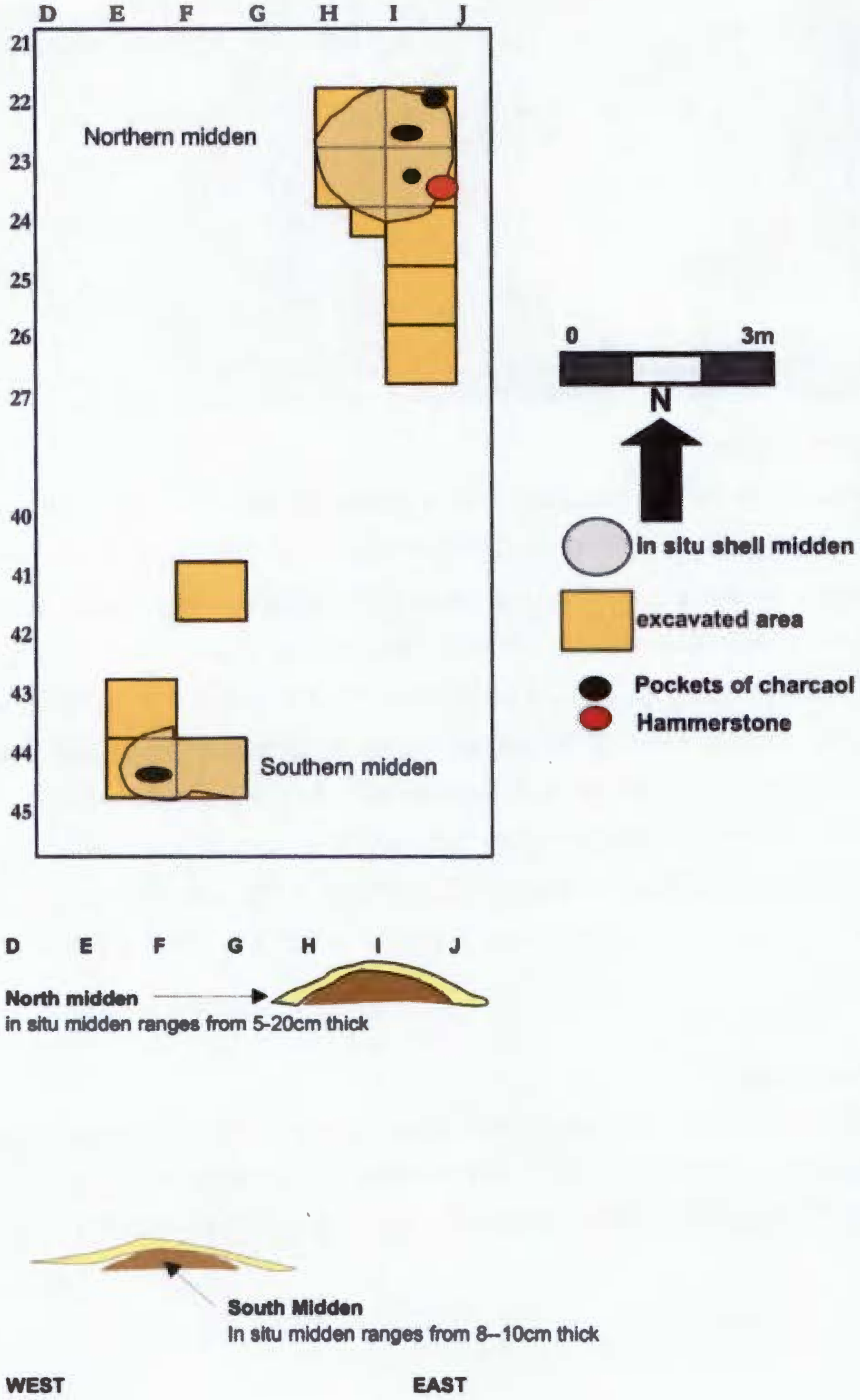
Introduction

TP2004-04 is an open-air shell midden located on the coastal plain of Namaqualand, South Africa (29° 29' 53.2"S 16° 59' 53"E). The site is found within the Buffels Marine Complex of the DeBeers mine, 18km north of the town of Kleinsee and the mouth of the Buffels River, and 1 km east of the Atlantic Ocean (Fig. 1.5). The site is on the lee side of a dune ridge, amongst open shifting sand, although the dune is stabilised by typical Strandveld vegetation. The nearest large freshwater source is the Buffels River, although typically it flows only once every decade. The site was identified in June 2004 by the Archaeology Contracts Office (Orton & Halkett 2005) during a phase one mitigation of potential mine blocks within the DeBeers Namaqualand Mine.

Excavation

TP2004-04 was excavated using standard methods including trowels, pans, buckets, and a 3 mm sieve. The extent of the shell scatter is approximately 30x10 meters, 11.25m^2 was excavated in 1m^2 squares with the exception of square H24b, which was excavated as a quadrant due to the high density of shellfish. In total 1.8m^3 of deposit was removed.

Figure 7.2 **Plan and schematic profile of the two middens at TP2004-04. The profile of the north midden is through row 22/23, while the profile of the south midden is through row 43/44**



Two discrete in situ middens were easily identified as they had the densest concentration of shells on the surface. Both middens are 2m in diameter and located 19m apart, one to the north and one to the south, both with single occupation layers (Fig. 7.2). The southern midden had a total depth of 10cm, while the northern midden had a total depth of 20cm (Fig. 7.2). It has become common practice to sub-sample the shell from archaeological sites, due to storage problems. Thus, we collected shellfish samples from rich squares in order to obtain a statistically significant sample. The samples involved collecting all the shellfish from squares H22 and I22d for the northern midden and squares E43 and F41 for the southern midden. As square I22 was particularly dense, only a quadrant of shellfish was kept for analysis.

Radiocarbon Dating

A single radiocarbon date was obtained for the northern midden on marine shell and the result is 990±60 BP (GX-32058). The calibrated date is 1479AD ranging from 1415-1622AD (two sigma).

Spatial distribution of archaeological material

Artefacts present at the site include lithics, pottery, ostrich eggshell, bone, crayfish, shellfish, and pockets of charcoal. Most of the lithics and the entire pottery assemblage are located within the northern midden (Figs. 7.3 & 7.4). A single fragment of ostrich eggshell was found in the southern midden and one ostrich eggshell bead in the northern midden (Fig. 7.5). There are faunal remains at both middens, but the small species, the fish and bird remains were located in the southern midden (Fig. 7.6). Crayfish was abundant in both middens but was more common in the southern midden (Fig. 7.7). Shellfish was sub-sampled and so there is no data on the spatial distribution of shell except for the plan drawing (Fig. 7.2).

Figure 7.3 The spatial distribution of lithics at TP2004-04. Values are number of lithics per square. Blue highlights areas of dense concentration with values greater than three lithics per square

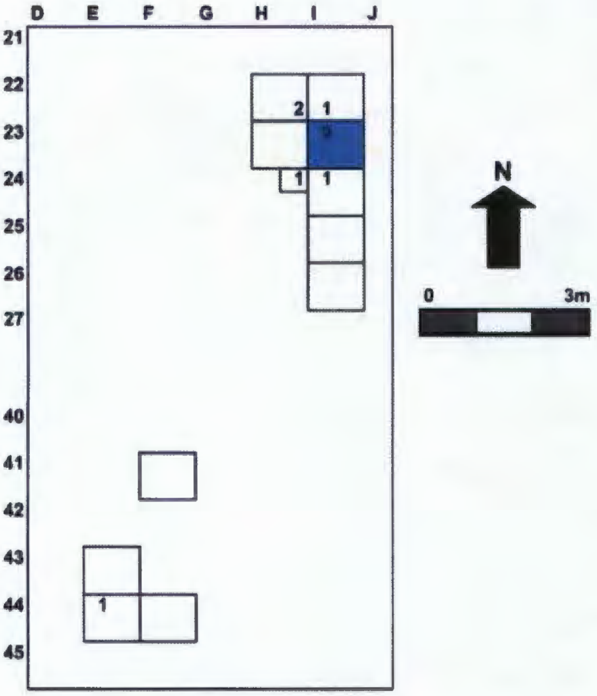


Figure 7.4 The spatial distribution of pottery at TP2004-004. Values are pottery sherds per square. Pink highlights areas of dense concentrations with values greater than three sherds per square in the southern midden

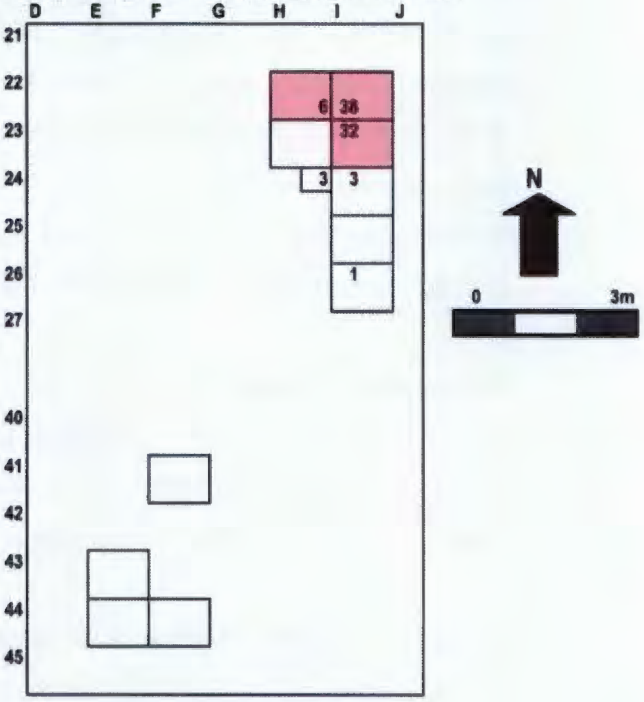


Figure 7.5 The spatial distribution of ostrich eggshell at TP2004-04. There is a single bead in the northern midden and a single fragment of ostrich eggshell in the southern midden

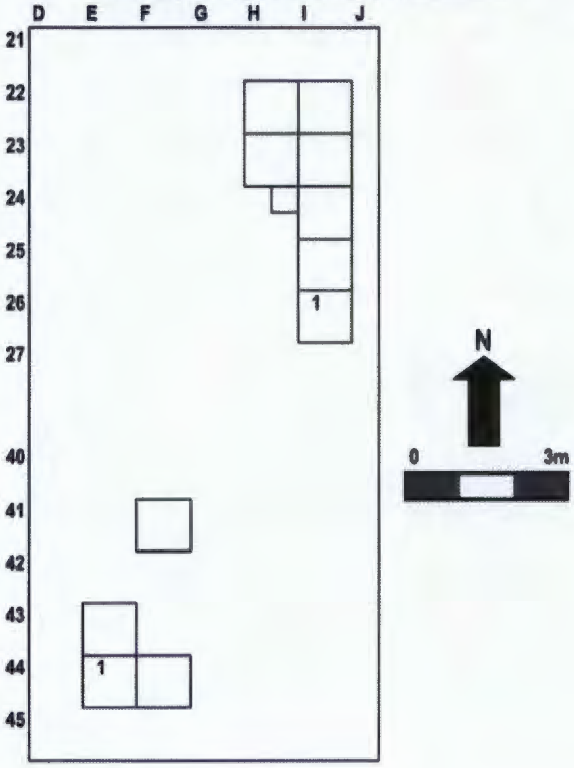


Figure 7.6 The spatial distribution of bone at TP2004-04. Values are number of bones per square. Green highlights areas of dense concentration with values greater than 5 bones per square

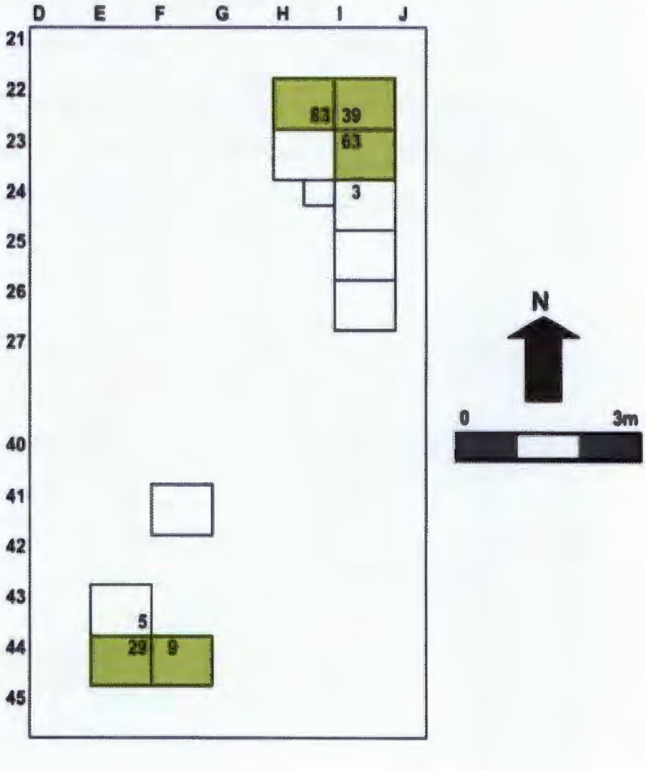
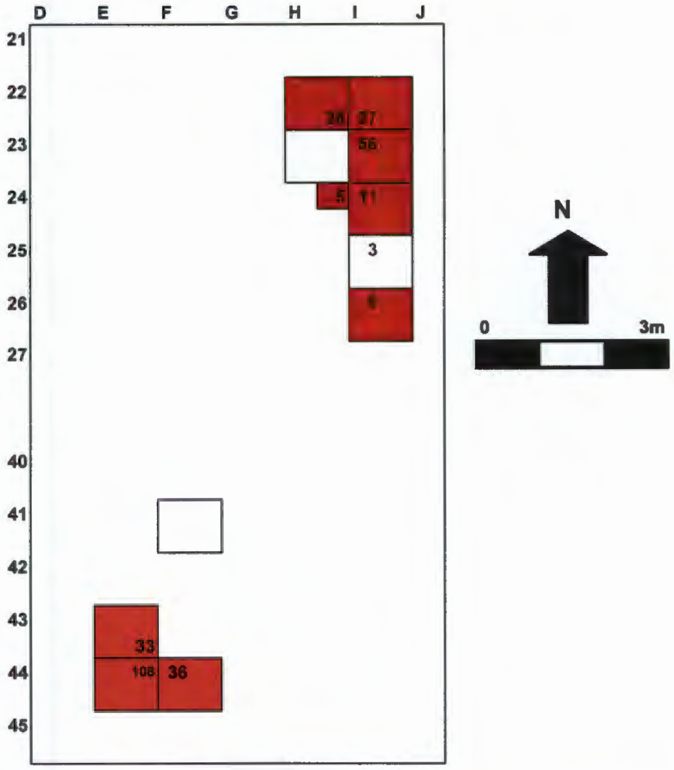


Figure 7.7 The spatial distribution of crayfish at TP2004-004. Values are the number of crayfish mandibles per square. Red highlights areas of dense concentration with values greater than four mandibles per square. Note square E44 has 108 mandibles



Lithics

Table 7.1 Lithic raw materials at TP2004-04

Stone	No.	%No.
Quartz crystal	12	80
Quartzite	1	6.7
Sandstone	1	6.7
Other	1	6.7
Total	**15**	

The stone assemblage identified by Jayson Orton consists of only 15 artefacts. However, all but one piece was found within the northern midden: a single manuport on an unidentified material was found in the southern midden. The primary raw material consists of quartz crystal at 80% of the assemblage, followed by coarse-grained quartzite and sandstone (Table 7.1). There are no formal tools, only expedient flakes and chunks, an irregular core, and an upper grindstone/ hammerstone (Table 7.2). The source of the quartz crystal is unknown, but it may come from the Spoeg River mouth area, 110km to the south, where it is particularly abundant in archaeological assemblages. It is also possible that it is available closer to TP2004-04. The other identified raw materials are local and available within a 20km radius, i.e. there is a mature quartz-rich sandstone outcrop near Kleinsee and an abundance of quartzite beach cobbles at the coast.

Table 7.2. **The lithic assemblage at TP2004-04**

Stone	No.	%No.
Quartz crystal		
Flake	8	53.3
Chunk	3	20
Debitage sub total	**11**	**73.3**
Irregular core	1	6.7
Core sub total	**1**	**6.7**
Quartzite		
Flake	1	6.7
Debitage sub total	**1**	**6.7**
Sandstone		
Hammerstone/upper grindstone sub total	**1**	**6.7**
Other		
Manuport	**1**	**6.7**

Pottery

There are a total of 83 pottery sherds weighing 171.4g in the assemblage all from the northern midden. The mean thickness of the sherds is 5.0 ±1.7 mm with a range from 1.4-8.6 mm. There are nine rim fragments, seven of which are decorated with a single line of impressed dots below the lip (Fig. 7.8). The remaining rims lack decoration. Eight of the rims have a rounded lip while the ninth rim has a pinched lip. Only three rim sherds were substantial enough to determine the original diameter of the opening: 20cm, 19cm, and 9cm. As two rims have similar opening diameters it is likely that they are from the same vessel, making an MNV of two, one large and one small pot. All of the sherds had a quartz temper and an admixture of specularite. Ethnographic evidence from the /Xam San of the Northern Cape, comment on the use of “glittering particles” in the matrix of their pots (Bleek and Lloyd 1911:343). The sherds were well preserved as 81% had both surfaces intact. There are no lugs or base fragments that could identify the shape of the vessel. The diameters of the mouths of the two smaller vessels are similar to that of an almost complete Cape coastal pot found 10km to the south (Fig. 7.9).

Figure 7.8. Rim sherds from TP2004-04

Figure 7.9. A small Cape coastal pot with typical rounded shoulder and conical base. This pot was found by D. Halkett at the seal colony at the Dreyer's Pan farm, Namaqualand, 10km south of TP2004-04

Ostrich eggshell

There are only two pieces of eggshell, a body fragment in the south midden and an unfinished bead in the north midden. The bead is oval and the aperture is in the centre of the bead. While the bead has been drilled through, the edges have not been grounded smooth, which identifies it as a stage 9, unfinished bead (Kandel & Conard 2005).

Charcoal

Several fragments of charcoal were recovered from both the northern and southern middens (Fig. 7.2), however only a small sample was collected for future identification of the plant species. These charcoal patches were insubstantial and probably do not represent the original hearths. Rather, these patches of charcoal are most likely the remains of someone cleaning out the hearth.

Bone

Subsistence strategy

Northern midden

The faunal sample is small at only 203 bones, of which 157 or 77.3% were identified to species or size class (Table 7.3). There are two identified species present, gemsbok (*Oryx gazella*) and angulate tortoise (*Chersina angulata*) as well as a size class two bovid, small mammal, and medium mammal remains.

Table 7.3 The vertebrate species identified at TP2004-04

Taxon		**North**		**South**	
		NISP	MNI	NISP	MNI
Bovid size class II		1	1		
Gemsbok	*Oryx gazella*	32	2	1	1
Cape fur seal	*Arctocephalus pusillus*			1	1
Small mammal		3	1	15	1
Medium mammal		106	/	13	/
Medium aves				1	1
Medium fish				4	1
Angulate tortoise	*Chersina angulata*	15	1	6	1
Total		**157**	**5**	**41**	**6**

Gemsbok (Oryx gazella)

The gemsbok sample consists of 32 elements from at least two individuals (Table 7.3), an adult and a juvenile. The adult remains consist of a range of elements from the skull, ribs, long bones and toes. Other than the long bone fragments and ribs, the elements are low utility discard bones suggesting that the primary butchering of the adult gemsbok occurred at the site. Unfortunately the sample size is too small to apply quantitative analyses to identify a specific economic strategy.

An ulna and two ribs, represent the juvenile. As the crania and foot bones are lacking, it suggests that the juvenile was processed elsewhere and the high utility ribs and long bones were brought to the site. The long bones of both individuals are heavily fragmented, most likely due to secondary processing for access to bone marrow.

Bovid size class II (BovII)

There is a single horn core fragment from the category BovII. There are three species that fall into this category in Namaqualand, springbok (*Antidorcas marsupialis*), grey duiker (*Sylvicapra grimmia*) and sheep (*Ovis aries*), but due to the fragmented nature of the frontlet it is difficult to identify which of these species the horn core belongs to. As crania are low utility elements, the BovII probably underwent primary butchery at the site.

Small mammal

There are 3 long bone shaft fragments that could only be identified to small mammal. These bones most likely belong to the BovII.

Medium mammal

There are 106 bones identified to medium mammal. The elements consist of ribs, vertebrae, scapulae, and long bone shaft fragments. This size class is particularly fragmented and most likely came from the two gemsboks.

Angulate Tortoise

A total of 15 carapace fragments were identified to angulate tortoise representing a minimum of one individual.

Thus, the north midden consists of large meat bearing species that most likely had to be hunted and a tortoise that is easily collected. This is a fairly narrow diet breadth.

South Midden

The faunal sample from the south midden is small at 43 elements with 41 or 95.3% identified to species or size class (Table 7.3). There are three identified species in the assemblage: gemsbok, Cape fur seal (*Arctocephalus pusillus*), and angulate tortoise. In addition, some elements could only be identified to small mammal, medium mammal, medium fish, or medium aves.

Gemsbok (*Oryx gazella*)

There is a single adult gemsbok molar with moderate wear indicating a middle-aged adult. Teeth are low utility refuse elements.

Cape fur seal (Arctocephalus pusillus)

There is an adult mandible without dentition identified to Cape fur seal. As the mandible is gracile it is most likely from a female. Mandibles are low utility elements, suggesting it was discarded after the animal was processed and the high utility elements were removed from the site.

Small mammal

A total of 15 vertebral fragments could only be identified to small mammal. As there are no identified species of that size, they probably belong to an as yet unidentified species.

Medium fish

There are three scales and a cranial bone from a single fish.

Medium aves

There is a single long bone shaft fragment from a bird the size of a Southern black Koraan (*Eupodotis afra).*

The range of species is broader in the southern midden with the addition of smaller species such as the small mammal, fish, and bird. Although the adult gemsbok and Cape fur seal suggest that people were able to exploit large a potentially dangerous species that in order to obtain require hunting skills. Otherwise, the small species are easily collected or snared.

Bone Modification

There were few modifications made to the bone sample from either midden (Table 7.4). At the southern midden, only two bones were burnt, the only modifications identified in that assemblage. For the northern midden, only six bones had evidence of being in direct contact with flame and one had evidence for carnivore gnawing (Table 7.4). The fracture patterns of the long bones consisted of both fresh green spiral breaks in 3.9% of the assemblage and dry bone longitudinal breaks in 2.0% of the assemblage (Johnson 1985). The lack of weathering and carnivore modifications suggest that the faunal assemblages from both middens were buried rapidly after abandonment.

Table 7.4 **Modifications identified on bone from TP2004-04**

Patch		Burnt	Gnawed	Spiral break	Transverse break
North (N=203)	No.	4	1	8	4
	% NO.	2.0%	0.5%	3.9%	2.0%
South (N=43)	No.	2			
	%No.	4.7%			

Crayfish (Jasus lalandii)

In the northern midden, there are 143 crayfish mandibles with an MNI of 80 based on left mandibles. The mean length of the left mandibles is 14.3±2.1mm with a range from 10.0-19.1mm. The mean length of the right mandibles is 16.0±2.7mm with a range from 10.6-21.6mm. Deriving the carapace length following Jerardino *et al.* (2002) produced a mean carapace length of 99.8±13.1mm with a range from 72.7-129.9mm based on left mandibles and 105.4± 16.1 with a range from 72.1-138.2mm based on right mandibles.

In total, there are 177 crayfish mandibles in the southern midden with an MNI of 91 based on left mandibles. The mean length of the left mandibles is 13.3±1.8mm with a range from 9.5-18.6mm. The mean length of the right mandibles is 14.3±2.0mm with a range from 10.5-19.3mm. Following Jerardino *et al.* (2002), the derivation of the carapace length is 93.2±11.5mm with a range from 65.6-126.8mm based on left mandibles and 94.2±12.1mm with a range from 71.5-124.4mm based on right mandibles.

The crayfish from the northern midden are statistically significantly larger than those from the southern midden (t-test: $t=3.85$, $df=98$, $p<0.001$).

Shellfish

The shellfish assemblage had to be sub-sampled due to the large frequency of shells: 1.75m^2 was sampled from the southern midden and 2m^2 from the northern midden. The sub-samples were obtained to determine the species composition and the length of the shellfish was measured when possible.

The northern midden is dominated by three limpet species, *Cymbula granatina* (43.9%), *Scutellastra argenvillei* (28.7%), and *S. granularis* (24.6%). There is also one *Conus* sp. shell and two periwinkles (Table 7.5). The southern midden shellfish assemblage consists only of *C. granatina* at 70.7% and *S. granularis* at 28.1% of the assemblage. The mean length of *C. granatina* is nearly identical for both middens at 55.0±7.5mm for the northern midden and 55.0±7.8mm in the southern midden (Table 7.6). The *S. granularis* samples are also nearly identical at 38.3±4.1mm for the northern midden and 39.0±3.7mm for the southern midden. The mean length of the *S. argenvillei* from the northern midden is 78.8±6.4mm.

Table 7.5 **Shellfish species identified at TP2004-04**

Species	North		South	
	MNI	% assemblage	MNI	%assemblage
Cymbula granatina	416	43.9	680	70.7
Scutellastra granularis	233	24.6	270	28.1
S. argenvillei	272	28.7		
Unidentifiable	23	2.4	12	1.2
Periwinkle	2	0.2		
Conus sp.	1	0.1		
Total	**947**	**100**	**962**	**100**

Table 7.6 **The average length and relevant statistics for the three dominant species at TP2004-04**

North	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
C. granatina	267	55.0	7.5	39	80
S. granularis	155	38.3	4.1	27	54
S. argenvillei	29	78.8	6.4	59	89
South					
C. granatina	250	55.0	7.8	38	75
S. granularis	231	39.0	3.7	30	52

The presence of *C. granatina* and *S. granularis* identifies the harvesting of the mid inter-tidal zone, while the presence of *S. argenvillei* in the northern midden identifies that people were present near or during a spring low tide, the only time the low inter-tidal zone is available for harvesting.

The lack of the black mussel (*Choromytilus meridionalis)* is of note as black mussels are popular within most other Later Stone Age shellfish assemblages along the west coast of South Africa as they grow on the same rocky outcrops as the limpet species. However, black mussels are prone to the toxic effects of red tides that occur during the summer months and perhaps people avoided this resource during this season.

Kilojoules

The kilojoules available in the northern midden is dominated by terrestrial versus marine species at 80% of the total kilojoules (Fig. 7.10). The species providing the most kilojoules to the diet is gemsbok at 72%, followed by the

BovII individual at 8% of the assemblage (Fig. 7.11 & Table 7.7). Shellfish accounts for 11% of the total available kilojoules.

The kilojoules available from the fauna in the southern midden is dominated by terrestrial species at 74% (Fig. 7.10). Once again gemsbok provide the most kilojoules at 72%, followed by the cape fur seal at 16% of the assemblage (Fig. 7.11 &Table 7.7). Shellfish provide only 5% of the total kilojoules available in the southern midden.

Figure 7.10 **The ratio of terrestrial and marine kilojoules at TP2004-04. The chart on the left shows the ratio of kilojoules from the northern midden, while the chart on the left shoes the values from the southern midden**

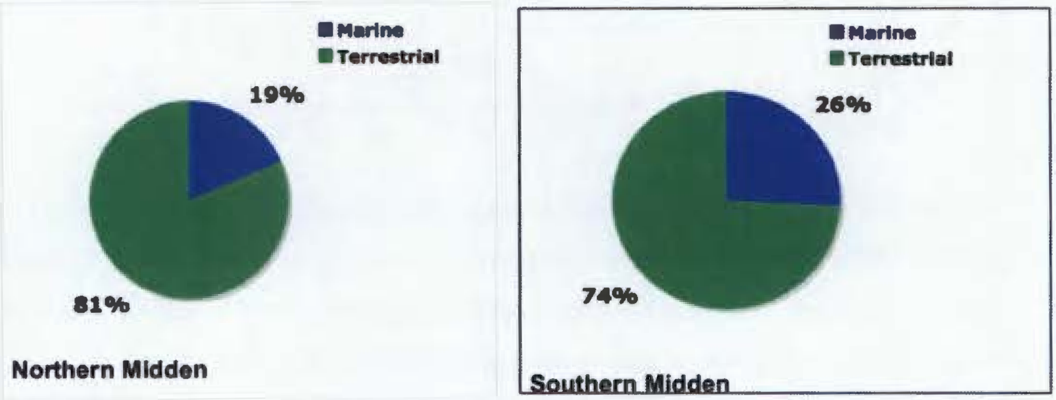


Figure 7.11 **The distribution of kilojoules by species at TP2004-04. The chart on the left shows the distribution of kilojoules from the northern midden, while the chart on the right shows the distribution of kilojoules form the southern midden**

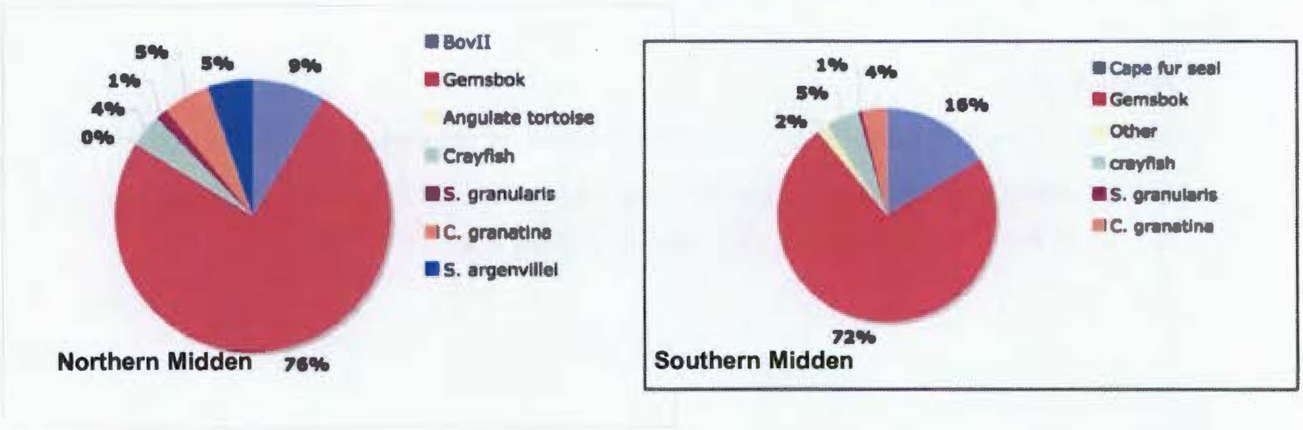


Table 7.7 **The distribution of kilojoules at TP2004-04**

Taxon	North			South		
	KJ/animal	Number of individuals	Total KJ	KJ/animal	Number of individuals	Total KJ
BovII	134,150	1	134,150			
Gemsbok adult	725,700	1	725,700	725,700	1	725,700
Juvenile*	435,420	1	435,420			
Cape fur seal				165,000	1	165,000
Small mammal				5,000	1	5,000
Medium mammal				40,000	1	40,000
Medium aves				10,000	1	10,000
Medium fish				1,000	1	1,000
Angulate tortoise	2,000	1	2,000	2,000	1	2,000
Crayfish	746.3	80	59,700	544.1	91	49,513.1
C. granatina	34.4	2,413	83,007.2	34.4	1,020	35,088
S. granularis	16.6	1,351.2	22,433.2	16.6	405	6,723
S. argenvillei	105	1,577.6	165,648			

***Assume a juvenile is 60% the value of an adult**

However, the gemsbok and the Cape fur seal are each represented by only a single tooth, suggesting that they may not have contributed much to the diet. Removing them from the analysis (Fig. 7.12) changes the results to a marine dominated diet; seafood provides 84% of the kilojoules, with crayfish (46%) and *C. granatina* (32%) providing the most energy.

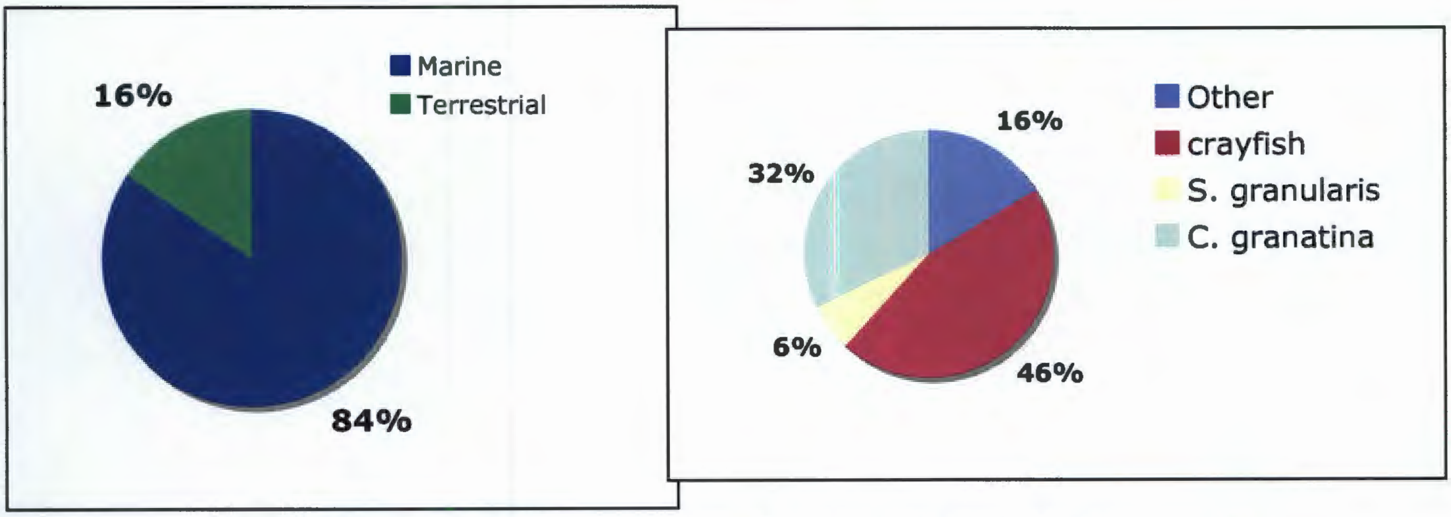


Figure 7.12 **The ratio and distribution of marine and terrestrial kilojoules not including cape fur seal and gemsbok**

Discussion and conclusion

The site of TP2004-04 is on a coastal plain, one km inland from the Atlantic Ocean and 18 km north of the nearest river. The site is on the lee side of a dune ridge that is being stabilised by local vegetation. There are actually two shell middens at the site, the northern and the southern middens, each with a single occupation layer.

Northern Midden

The in-situ shell deposit 2m in diameter with a maximum depth of 20cm. The calibrated radiocarbon date from the northern midden places the occupation at roughly 1479 AD. The northern midden has all the lithic artefacts and pottery plus the majority of the bone. There are no features but the presence of pockets of charcoal suggests that hearths were nearby.

The stone assemblage is a typical made when needed, expedient assemblage of flakes and chunks with an irregular core made on quartz crystal. The ground tools consist of one dual function hammerstone/upper grindstones, but there are no corresponding lower grindstones. The source of the quartz crystal remains unknown, but it may be from the Spoegriver mouth, 110km south or possibly from a closer source. The other identified raw materials are locally available.

There is evidence for at least two decorated pots with a single line of impressed dots. One pot is small at 20mm diameter similar to pots we have found at other sites. The second pot is large with a diameter of 90mm.

The ostrich eggshell assemblage is remarkably small at one unfinished ostrich eggshell bead. The faunal assemblage is highly fragmented with two gemsbok dominating the dietary kilojoules. The adult most likely underwent primary butchery at the site while the juvenile was butchered elsewhere. The presence of a BovII horn core suggests that the high utility elements of this species were removed from the site leaving the refuse behind. In addition there is a small mammal and a tortoise. This pattern suggests a subsistence strategy focussing on a narrow diet breadth with large meat animals that need to be hunted, supplemented by a few small easily snared or collected species. The contribution of marine species to the diet is quite minimal and while shellfish and crayfish are a predictable and plentiful resource, they are clearly not nearly as high ranking as the gemsbok. Overall this midden seems to be a shallow contained deposit from a short occupation or processing site.

Southern Midden

The in situ southern shell midden is 2m in diameter with a maximum depth of 10cm. The only stone in the midden is an unidentified manuport. There is a small ostrich eggshell assemblage with one ostrich eggshell fragment. The southern midden typifies a wider diet breadth with the inclusion of a range of smaller species such as a medium bird, medium fish, and tortoise in addition to the larger meat bearing species. An adult gemsbok and Cape fur seal were identified in the assemblage, but as single teeth represent them it is difficult to determine how much they contributed to the diet. In any case, marine species such as crayfish and shellfish are important to the diet, as there is a fair number of crayfish at the site, which are relatively large.

While the shellfish and crayfish are predictable and plentiful resources, the people who occupied the southern midden may have focused on a subsistence strategy that hunted large meat animals, but supplemented their diet with a range of smaller species. Potentially heavily processed gemsbok and Cape fur seal suggests that this midden was a processing site, collecting resources to take elsewhere.

The patterns identified at these two middens suggest that they are not contemporaneous. The southern midden lacks lithic artefacts and pottery, while the northern midden has a higher concentration of bone and the shellfish species *S. argenvillei*. The lack of pottery in the southern midden suggests that it is the older deposit. The northern midden reflects a subsistence strategy hunting large meat animals, while the southern midden may be dominated by smaller marine species. In addition, the fact that the south midden lacks the shellfish species *S. argenvillei* suggests that the two occupations were not deposited at the same time of month: the northern midden was deposited near or during a spring tide, while the southern midden was most likely deposited near a neap tide. While the shellfish are nearly identical in mean length, it is most likely due to harvesting the same rocky headlands, with people collecting the largest individual available.

Chapter Eight: DP2004-014

Figure 8.1 The west view of squares L15, M15, and M14 of the site DP2004-014. The soft sand prevented neat sections

Introduction

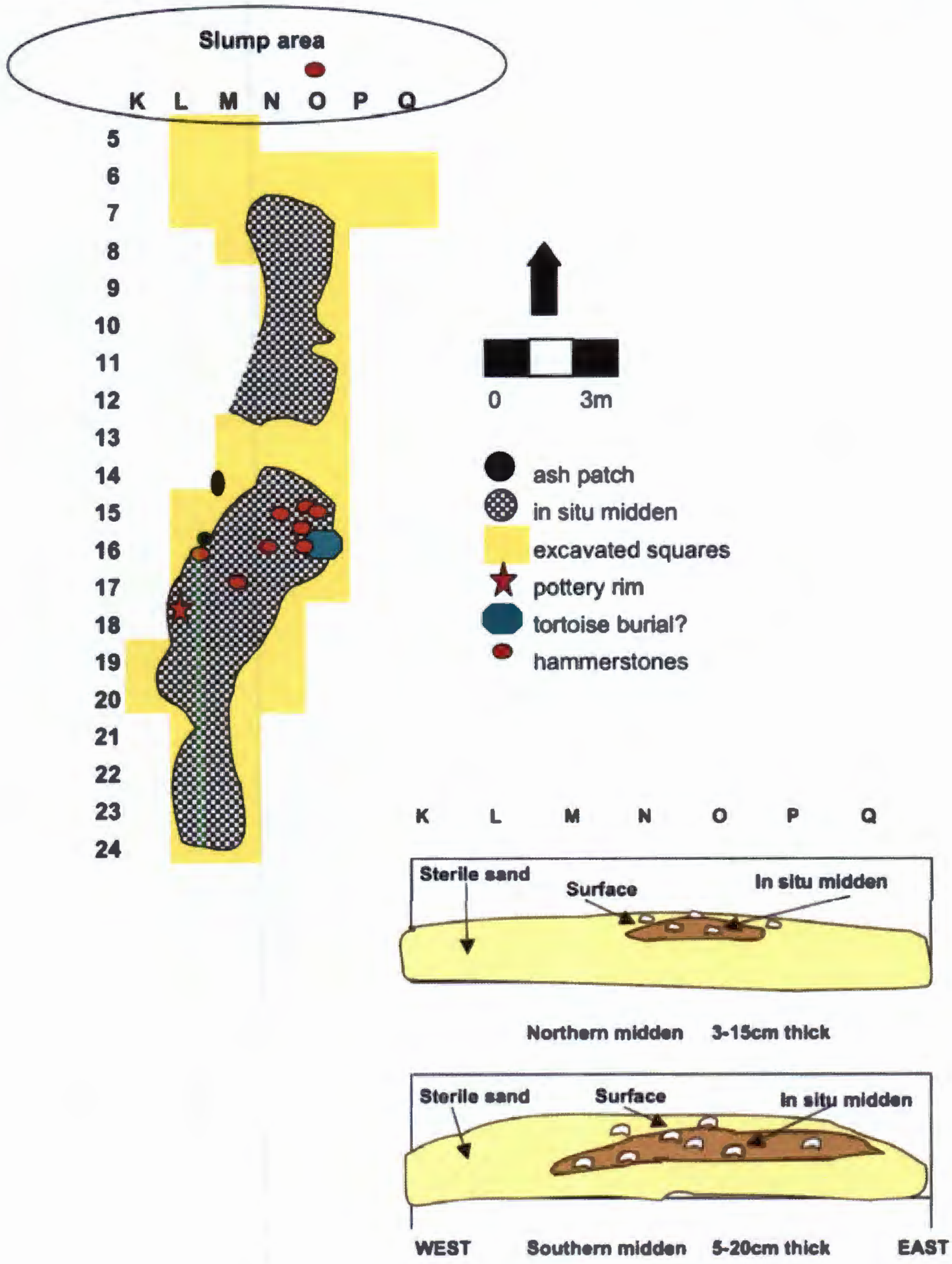
DP2004-014 is an open-air shell midden located in a deflation area, surrounded by hummocks, on the top of a large dune ridge. The dune ridge is on the eastern edge of a dune sea or a sand transport corridor that extends northward from Stompneus Bay (29° 35' 58.8" S 17° 02' 58.2" E). The site is 2.3 km east of the Atlantic Ocean and 6.6 km north of the Buffels River (Fig 1.5). DP2004-014 was identified in 2004 during archaeological survey at the De Beers Namaqualand Mines, ahead of open cast diamond mining. A small scale excavation was carried out (Orton & Halkett 2005). The surface of the remaining unexcavated shell midden had unfinished ostrich eggshell beads and preserved bone, so we returned in 2005 to excavate a larger sample of the site.

Excavation

DP2004-014 was excavated using standard measures including a trowel and pan, a 3 mm sieve, and a 1mm sieve, in order to collect the smallest artefacts.

artefacts. In total, 62m^2 were excavated in 1m^2 units, removing 5.8m^3 of shell midden. There are two areas of in-situ shell middens that run in a north-south direction (Fig. 8.2). Both middens consist of a distinct layer indicating a single occupation event. The northern midden ranges from 3-15cm in thickness, while the southern midden ranges from 5-20cm (Fig. 8.2). As many of the unfinished beads were located on a deflated slumped area beside the in-situ midden, the surface of the slump area was also collected (Fig. 8.2).

Figure 8.2 **Plan and schematic profile of DP2004-014. The northern midden profile is shown along the intersection between rows 7&8, while the southern midden shows the intersection between rows 15&16**



Features

There are two ashy patches on the western edge of midden, more or less in the centre of the site on the west side of the midden (Fig. 8.2). The ash patches are shallow and devoid of charcoal and are probably the remains of someone cleaning out a hearth.

Radiocarbon dates

A single radiocarbon date was obtained for this midden on marine shellfish. The result is 1020±60BP (GX-32060) calibrated to 1462AD, ranging from 1397-1549AD (two sigma).

Spatial distribution of archaeological material

The identified archaeological material includes lithics, a piece of pottery, ostrich eggshell fragments, beads, bone points and faunal remains, crayfish, and modified shellfish (Figs. 8.2 to 8.6). The lithics are distributed in two clusters, a large cluster at the north end of the southern midden and a small cluster at the north end of the northern midden (Fig. 8.3). All the hammerstones are in the southern midden (Fig. 8.2). There is a single piece of pottery at the site, located in the southern midden (Fig. 8.2). There are three categories of ostrich eggshell, the fragments including the flask mouths, the unfinished beads, and the finished beads. Fragments and unfinished beads are distributed in two patches, following the same pattern as the lithics: patches at the north end of the south midden and the north end of the north midden (Fig. 8.4). Finished

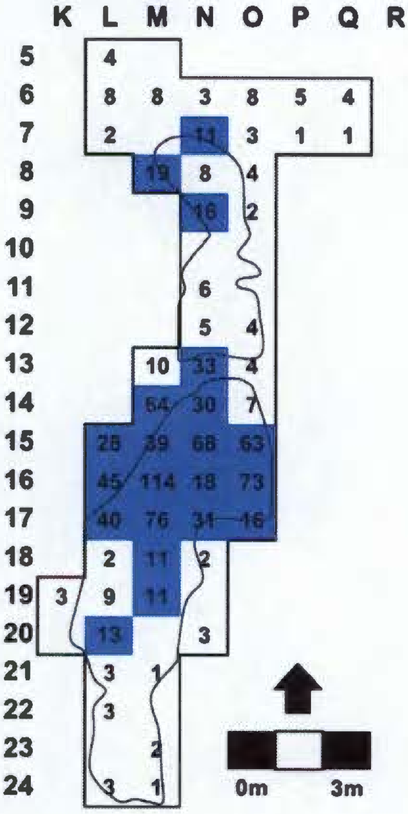


Figure 8.3 The spatial distribution of the lithics at DP2004-14. The values are lithics per square. Blue highlights the areas of dense concentration with values greater than 10 lithics per square

beads however, are concentrated in the middle of the site (Fig. 8.4). Bone is distributed across the site, with three areas of dense concentration, one at the north end of the south midden, one at the south end of the south midden and one a the north end of the north midden (Fig. 8.5). However, the distribution of the bone tools is similar to that of the finished beads: they are in the centre of the site (Fig. 8.5). The crayfish mandibles are scattered across the site, but are most dense in the north end of each midden, as well as a pocket in the southern end of the south midden (Fig. 8.6). The majority of the modified shell is in the north end of the northern midden (Fig. 8.6). Due to sub-sampling the shellfish, there is no data regarding spatial distribution.

Figure 8.4 **The spatial distribution of ostrich eggshell fragments and beads at DP2004-014. The left map shows the distribution of fragments, while the top right map shows finished beads and the bottom right map shows unfinished beads. The values are the number of fragments or beads per square. Orange highlights areas of dense concentrations with values greater than 30 fragments per square in the left map, and greater than 2 beads per square for both the finished and unfinished bead maps.**

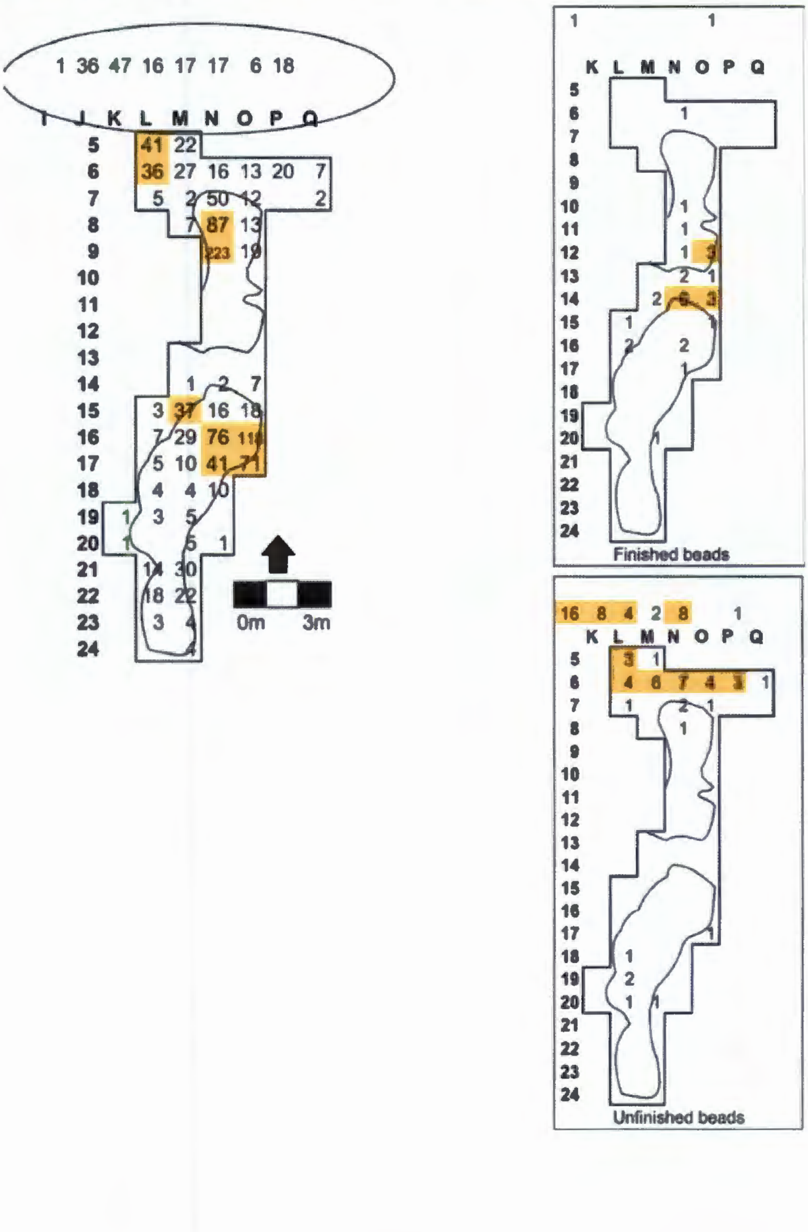


Figure 8.5 The spatial distribution of bone and bone artefacts at DP2004-014. The left map shows the distribution of the bone refuse, while the right map shows the modified bone tools. The values in the left map is the number of bones per square, while the right map is shows the number of artefacts per square. Green highlights the areas of dense concentration of material greater than 80 bones per square for the left map and values greater than one artefact per square for the right map

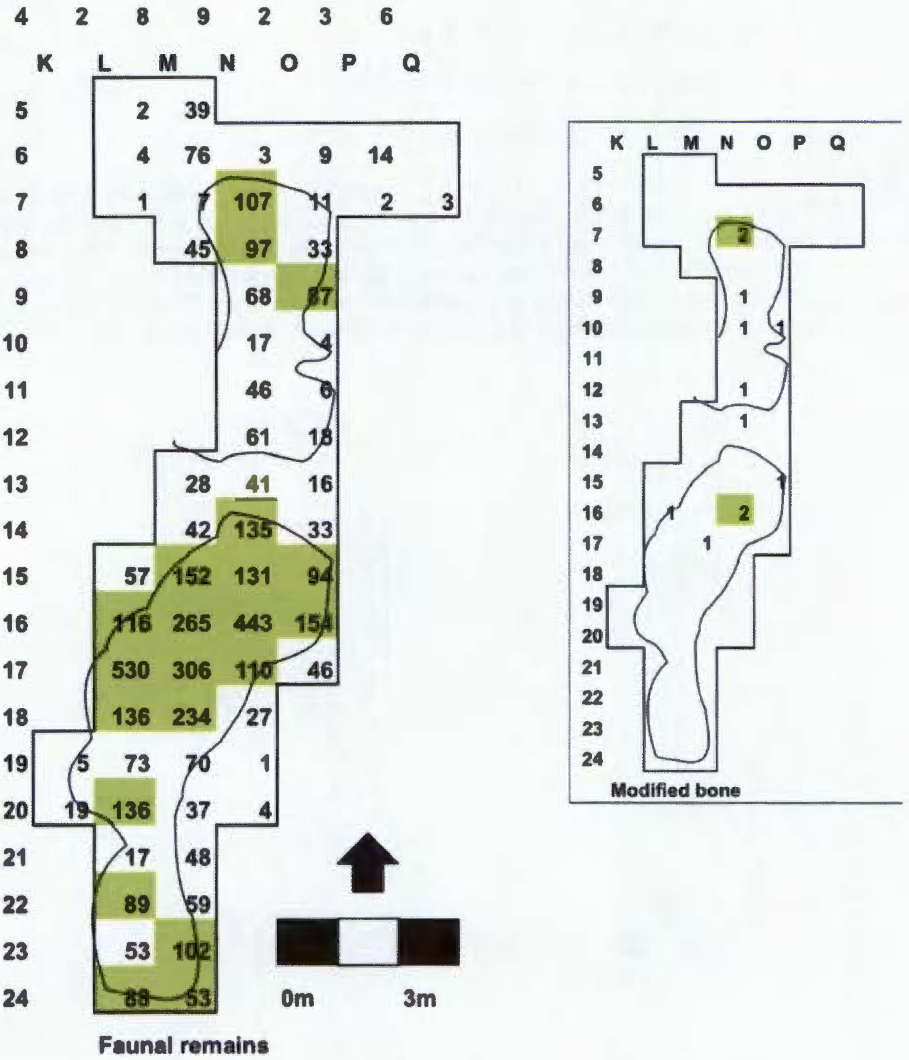
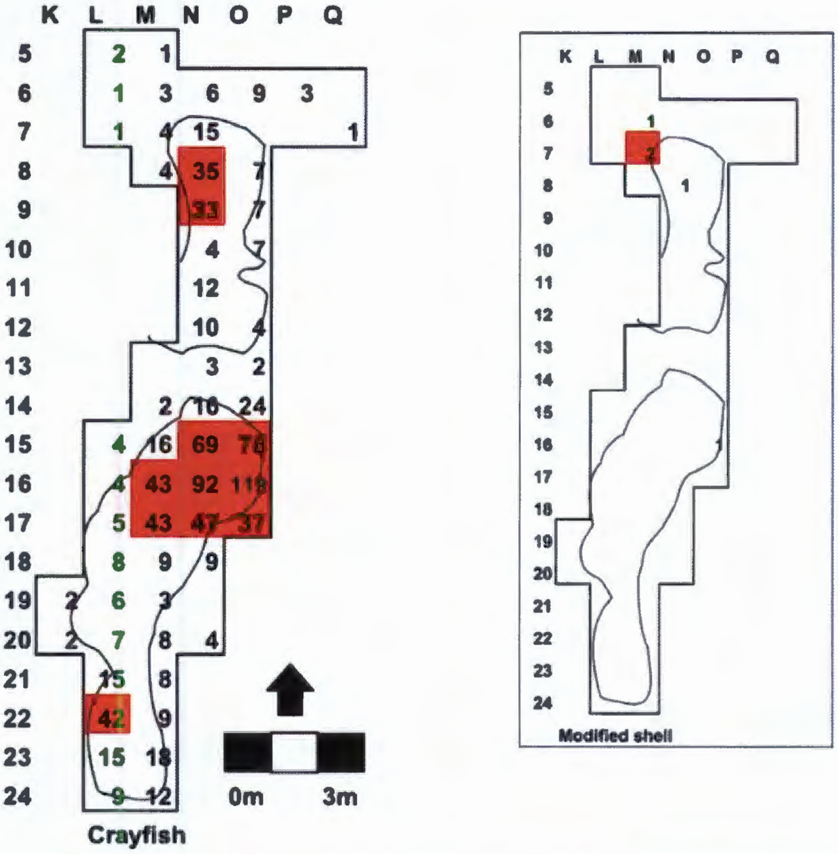


Figure 8.6 **The spatial distribution of crayfish and modified shellfish at DP2004-014. The left map shows the distribution of crayfish mandibles, while the right map shows the modified shellfish. The values are number of crayfish mandibles per square on the left and the number of modified shells on the right. Red highlights the areas of dense concentration with values greater then 30 mandibles per square on the left and values greater than one shell per square on the right**



Perhaps the centre of the site is where a shelter was established and/or where people sat to work, leaving an open area. The artefacts found in this central area are the bone tools, worn finished beads, and a few bone fragments, suggesting that people sat there to work on the bone tools, while eating some meat and leaving beads and bones in place. There are two concentrations of refuse, one to the north and one to the south of the void. While the two concentrations consist of the same waste material, 94.2% of the unfinished beads and 80% of the modified shells, associated with female activities are found in the northern most area. Similarly, 88.7% of the lithics that are typically associated with males are located in the southern area. The two middens may in fact the result of two gender-based activities (cf. Wadley 1987).

Lithics

The stone assemblage was analysed by Jayson Orton. It consists of 948 pieces, primarily milky quartz with a few quartz crystal chips and chunks at 85.2% of the assemblage (Table 1). Other raw materials at the site are quartzite, sandstone, and cryptocrystalline silicate (CCS).

Table 8.1 **Lithic raw materials at DP2004-014**
*A few chunks and chips are actually quartz crystal

Stone	No.	%No.
Milky quartz*	808	85.2
Quartzite	104	11.1
Sandstone	34	3.6
CCS	2	0.2
Total	**948**	**100**

Table 8.2 **The lithic assemblage at DP2004-014**

Stone	No.	%No.
Milky quartz		
Backed point fragment	1	0.1
Formal sub total	**1**	**0.1**
Flake	378	39.9
Chunk	214	22.6
Chip	184	19.4
Blade	2	0.2
Bladelet	7	0.7
Debitage sub total	**785**	**82.8**
Edge damaged manuport	**1**	**0.1**
Bipolar core	15	1.6
Irregular core	5	0.5
Single platform core	1	0.1
Cores sub total	**21**	**2.2**
Quartzite		
Flake	43	4.5
Chunk	16	1.7
Chip	4	0.4
Debitage sub total	**63**	**6.6**
Single platform core	1	0.1
Core sub total	**1**	**0.1**
Lower grindstone	1	0.1
Grindstone sub total	**40**	**4.2**
Manuport	**39**	**4.1**
CCS		
Flake	2	0.2
Debitage sub total	**2**	**0.2**
Sandstone		
Hammerstone	1	0.1
Hammerstone/upper grindstone	6	0.6
Hammerstone/upper grindstone fragment	2	0.2
Upper grindstone fragment	3	0.3
Hammerstone/grindstone sub total	**12**	**1.3**
Manuport	**22**	**2.3**

There is only one formal tool, a broken backed point on milky quartz. Debitage accounts for 89.6% of the assemblage and consists of flakes, chunks, and chips on milky quartz and quartzite, as well as blades and bladelets on milky quartz (Table 8.2). There is also one flake on CCS (Table 8.2). Cores contribute 22.3% of the assemblage with milky quartz dominated by bipolar cores, followed by irregular cores and one single platform core (Table 8.2).

There is also a single platform core on quartzite. The flakes and corresponding cores are fairly large (5-15cm). There is one hammerstone, six hammerstone/ upper grindstones, two fragments of a hammerstone/upper grindstone, a broken upper grindstone, and a lower grindstone fragment, all made on coarse grained quartzite or sandstone and account for 1.4% of the assemblage. There are 62 manuports on all materials except for CCS and the milky quartz manuport has edge damage. The presence of hammerstones, debitage, and cores suggests that lithic activities occurred on site, but the industry is informal or expedient.

The presence of both upper and lower grindstones indicates that grinding activities could have occurred on site.

Pottery

There is a single piece of dark brown pottery, a rim sherd with a rounded lip weighing 1.0g. The matrix is medium coarse clay with a dense quartz temper. There is no decoration. The dimensions of the sherd are 4.5x15.8 x11.7mm. Unfortunately, the length of the rim that is preserved is too small to determine the original diameter of the pot.

Ostrich Eggshell

Fragments

The sample of ostrich eggshell from this site is large at 1355 fragments weighing 1011.8g. 17 flask mouth fragments were identified on the based on the ground edge and oblique angle of breakage on the aperture. There is little evidence for intentional heat alteration as only 55 pieces or 4.1% are burned (ranging from lightly charred to fully calcined). The ostrich eggshell shows some evidence for taphonomic processes, as 15 pieces are wind eroded, 10 have canine punctures, and 4 have canine incisions.

Beads

In addition to the 310 stage 1 bead preforms, there are 31 finished beads and 82 unfinished beads. The finished beads have a mean external diameter of 5.5±0.8mm ranging from 4.4-7.9mm and a mean aperture size of 2.1±0.4mm ranging from 1.5-3.0mm (Figs. 8.7 & 8.8).

Figure 8.7 The external diameter versus the aperture diameter of the ostrich eggshell beads at DP2004-014

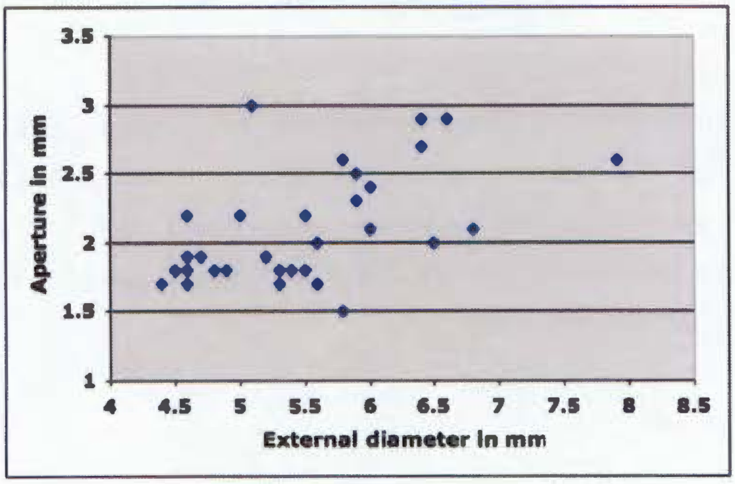
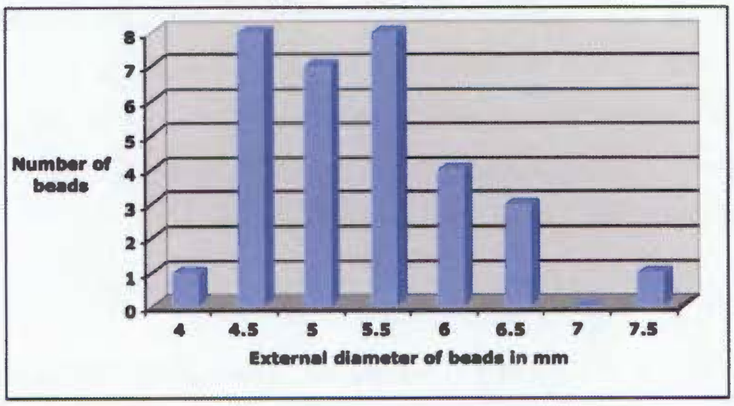


Figure 8.8 A histogram showing the distribution of external diameters of ostrich eggshell beads at DP2004-014



All of the beads are drilled from the inner surface. The majority of the finished beads exhibit evidence for wear as 44% of the beads are no longer round; they are oblong (n=15), triangular (n=2) or square (n=1) and the aperture of 28 beads exhibit a clear wear facet. One bead is interesting as it has a large aperture size of 3mm and an external diameter of only 5.1mm, so that it looks like a ring.

The 89 unfinished beads have been classified following Kandel & Conard (2005). Most stages are present from drilling to rounding the edges, but they are all broken, and there are no unfinished beads ready for the next stage i.e. there are no stage 5, 7, or 9 beads (Figs. 8.9 & 8.10). The majority of broken unfinished beads are in stage 6, i.e. they are broken perforated blanks.

Figure 8.9 The distribution of the stages of bead manufacture following Kandel & Conard 2005.

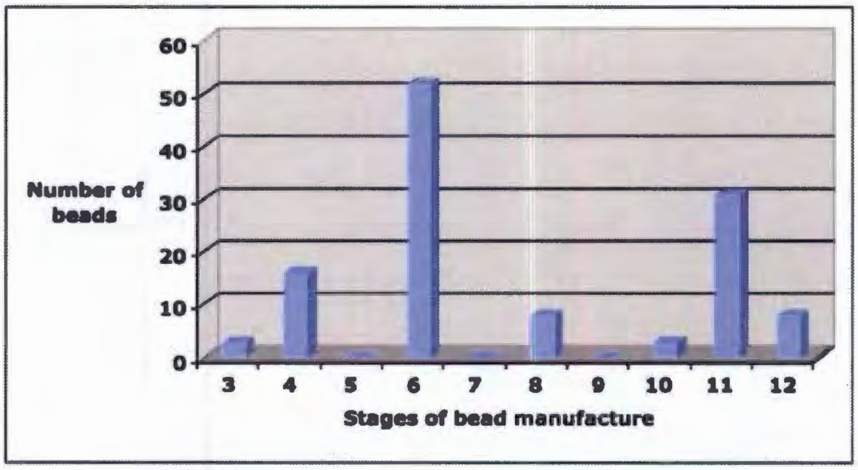


Figure 8.10 The various stages of bead manufacture at DP2004-014. Top row from left to right, stage: 3, 4, 6,6,6,6. Bottom row from left to right stage: 8, 10, 10, 11, 12

Bone

Artefacts

The site is rich in modified bone that is described following Schweitzer (1979). The bone artefact assemblage consists of points, awls, and polished bone. One bone point is 172.7mm in length, it is ground to a point and the distal end is a flat peg (Fig. 8.11). There are an additional three awl fragments ranging in length from 21.2-67.5mm. There is an additional point that is the tip of either an awl or bone point that is 21.0mm long. Two pieces of ground bone could be a point or a link shaft, but they are too fragmented to identify. These are 22.5mm and 41.3mm in length. There are six pieces of bone with evidence for grinding on the side of a long bone shaft fragment ranging in length from 21.0mm-36.2mm. In addition, there are four long bone shafts that have been ground, polished, and browned or slightly burnt. They range in size from 18.2-37.4 mm in length. All of the modified bone is made from the long bone shaft of a small mammal (Fig. 8.11).

Figure 8.11 The bone artefacts at DP2004-014

Shellfish artefacts

Five *Conus sp.* shells are perforated and exhibit definite wear facets, suggesting they were strung together (Fig. 8.12).

Figure 8.12 Modified shellfish at DP2004-014

Subsistence Strategy

The faunal assemblage consists of 4806 bones weighing 3.0kg. 1456 bones or 30.2% were identified to species or lowest possible taxon, however the assemblage is highly fragmented, preventing a more accurate analysis. The species list (Table 8.3) consists of a moderate cross section of the available fauna in the region. The most abundant species in the faunal assemblage is angulate tortoise (*Chersina angulata*), followed by Cape fur seal (*Arctocephalus pusillis*), and steenbok (*Raphicerus campestris*) (Table 8.3). Other species identified at the site include grey duiker, gemsbok, suricat, wildcat, springhare, whale, ostrich, and Brant's whistling rat.

Table 8.3 The identified vertebrate species at DP2004-014

Taxon		NISP	MNI
Steenbok	*Raphicerus campestris*	143	4
Grey duiker	*Sylvicapra grimmia*	8	1
Gemsbok	*Oryx gazella*	1	1
Bovid size class ii		120	3
Cape fur seal	*Arctocephalus pusillis*	147	5
Suricat	*Suricatta suricatta*	11	1
Wild cat	*Felis lybica*	5	1
Small Carnivore		11	2
Whale sp.		28	1
Springhare	*Pedestes capensis*	1	1
Small mammal		478	/
Small-medium mammal		39	/
Medium mammal		14	/
Medium-large mammal		20	/
Brant's whistling rat	*Parotomys brantsii*	9	3
Otomys/Parotomys		4	2
Micromammal sp.		13	3
Ostrich	*Struthio camelus*	15	1
Medium Aves		3	1
Frog		3	2
Large snake		12	1
Snake		44	1
Angulate tortoise	*Chersina angulata*	327	10
Total		**1456**	**45**

Steenbok (Raphicerus campestris)

There are 143 steenbok bones representing at least four individuals based on four right proximal tibiae. All elements are present except for the smallest bones (Fig. 8.13). Based on the dentition there is a minimum of two immature individuals and an adult. In one set of dentition, the third molar is just erupting, which occurs at 12 months of age in steenbok (Manson 1984). One individual already has their third molar, but it still has its deciduous premolar, placing it between 1 and 2 years of age (Manson 1984). The third set of teeth is from an old adult with heavy wear. The presence of a horn core indicates the presence of at least one adult male.

Figure 8.13 **The element distribution of steenbok at DP2004-014. The MNI (100%)=4**

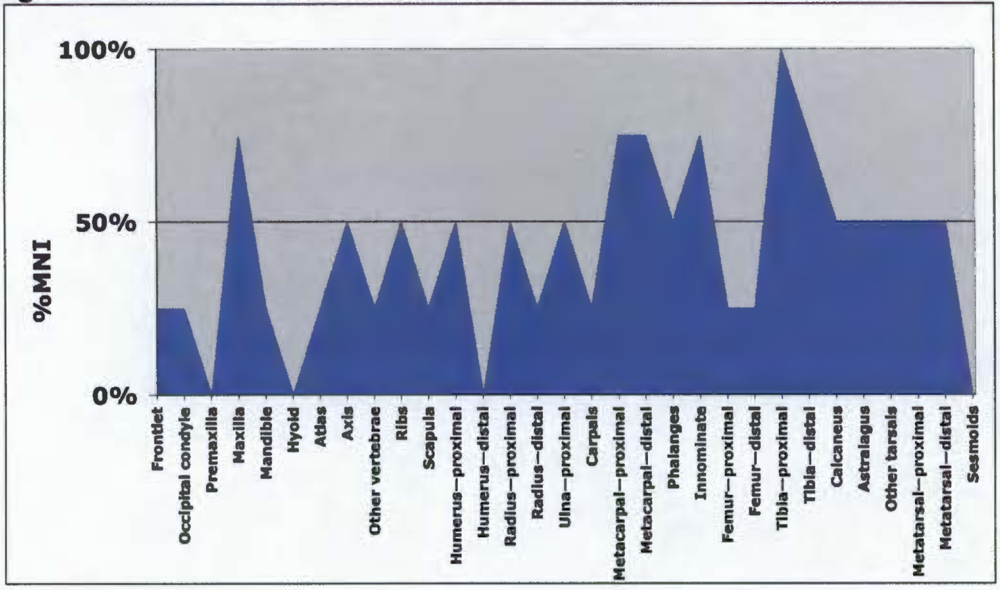
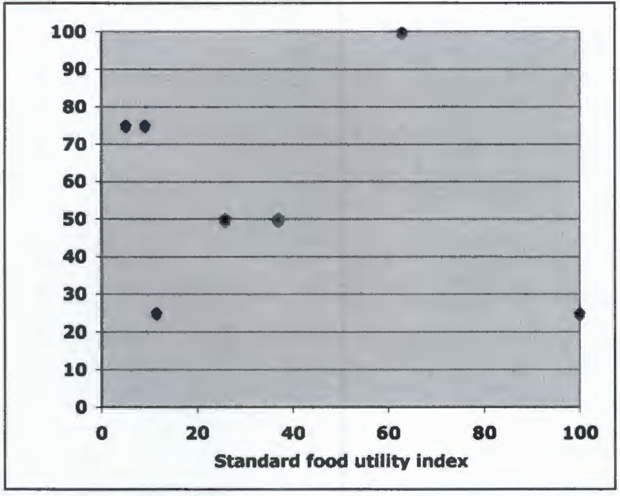


Fig. 8.13 shows that the assemblage is dominated by the hind limbs or high utility elements. As the NISP for steenbok is greater than a hundred, quantitative measures can be applied to analyse the cause of the missing elements. The %MNI of the elements were plotted against bone density (Lam *et al.* 1999, 2003, Lam & Pearson 2004) but there was no correlation (Pearson's r^2=0.14) suggesting it was not post-depositional processes causing differential preservation of the bone causing the loss of fragile bones. Plotting the %MNI of the high utility elements against the standardized food utility index (Metcalf & Jones 1988) (Fig. 8.14) and applying Shannon's evenness index and Spearman's rho, suggests that the missing bones are attributed to various economic strategies (Table 8.4).

Figure 8.14 **Scatterplot comparing the %MNI of steenbok elements from DP2004-014 with the standardized food utility index. Note only the high utility elements were used**



The result of Shannon's evenness index is 0.603, a value between a gourmet strategy and an unbiased strategy (Faith & Gordon 2006) both of which focus on returning the best cuts of meat to a site. However, ranking the elements produced a Spearman's rho value of -0.247, p=0.5552, which corresponds more closely to an unconstrained economic strategy whereby the entire carcass is returned to site (Faith & Gordon 2006). This suggests that not one strategy was being applied to the steenbok, but parts of various animals arrived at the site in different packages. While secondary bone marrow processing can account for the missing or shattered forelimbs, it does not explain the missing skull and rib bones.

Table 8.4 **The %MNI, Standard food utility index, and %MMUI for steenbok, BovII, and Cape fur seal from DP2004-014**

Element	Steenbok		BovII (incl. duiker)		Cape fur seal	
	SFUI	%MNI	SFUI	%MNI	%MMUI	%MNI
Femur	100.0	25	100.0	66.6	13.9	60
Tibia	62.8	100	62.8	33.3	6.4	40
Metatarsal	37.0	50	37.0	33.3	4.8	0
Humerus	36.8	50	36.8	33.3	22.2	60
Radius	25.8	50	25.8	33.3	13.6	80
Mandible	11.5	25	11.5	33.3	*	*
Cranium	9.1	75	9.1	100.0	62.8	20
Metacarpal	5.2	75	5.2	66.6	7.5	0
N	143		128		147	
Evenness	0.602		0.5539		0.383	
Spearman's rho	-0.247		-0.110		0.543	
P	0.5552		0.7955		0.2078	
Result	Gourmet & unconstrained strategy		Gourmet& Unconstrained strategy		Gourmet strategy	

*The derivation of the %MMUI includes mandibles with crania

Grey duiker (Sylvicapra grimmia) and bovid size class II

There are eight bones identified to duiker representing a minimum of one individual. There are also 120 bones that could only be identified to bovid size class II (BovII), which includes springbok, grey duiker, and sheep. However, as there is no evidence for either springbok or sheep at the site, it is likely that the BovII sample is grey duiker with 128 bones, and an MNI of 3. Most elements are present with the exception of the distal humerus, proximal metatarsal, occipital condyles, and sesmoids (Fig. 8.15). As the NISP of the BovII sample is greater than a hundred, quantitative measures can be applied to the sample to indicate the cause of the missing elements. Plotting the elements against bone density produced no correlation (Pearson's r^2= 0.02). However, plotting the %MNI of the high utility elements against the standard food utility index produced values that suggest a gourmet and unconstrained economic strategy (Fig. 8.16 &Table 8.4) were applied to these medium size bovids. Shannon's evenness index E=0.554 with is consistent with a gourmet strategy (Faith & Gordon 2006), while Spearman's rho=-0.11, P=0.7955, which is consistent with an unconstrained strategy, returning the whole carcass to the site. This pattern suggests that some times primary butchery occurred at DP2004-014, while in other instances, only the best cuts of meat were returned to the site.

Figure 8.15 **The element distribution of BovII (including duiker) at DP2004-014. The MNI (100%) =3**

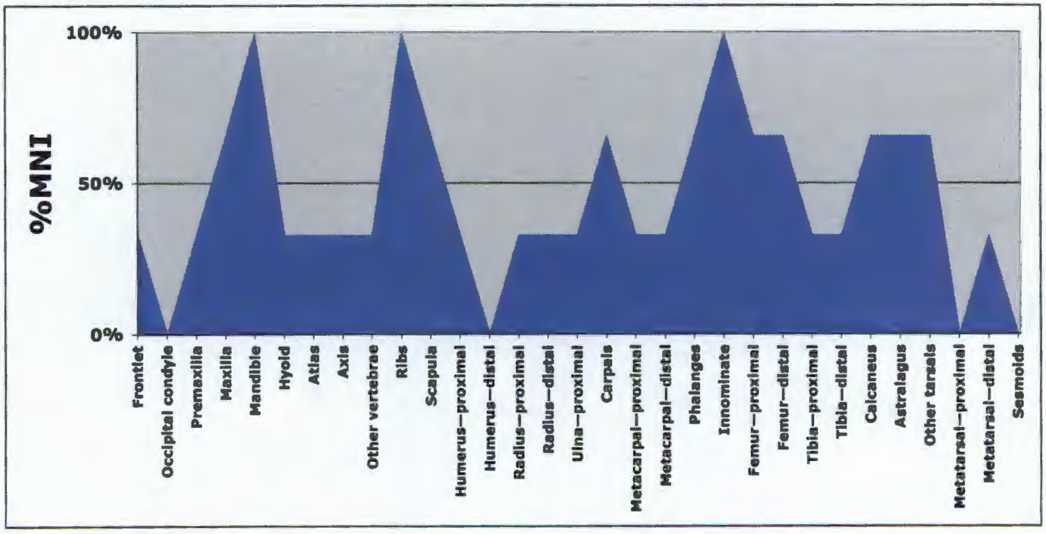
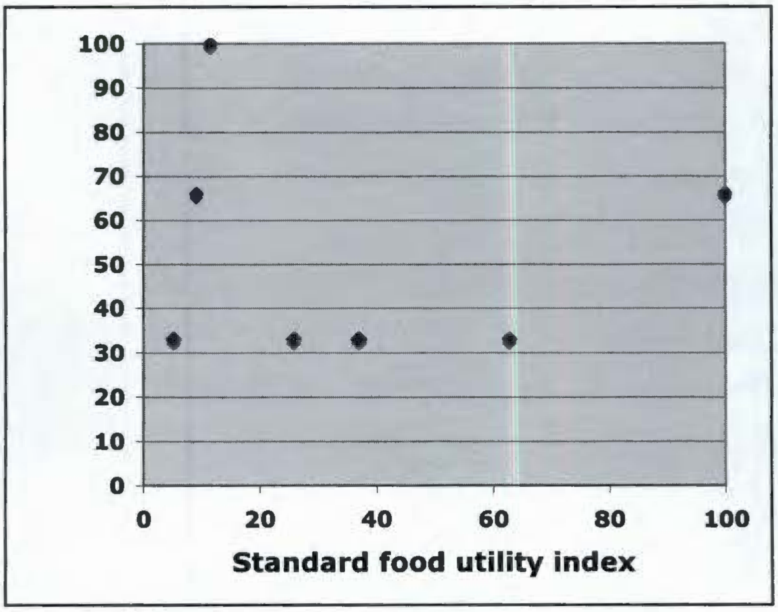


Figure 8.16 Scatterplot comparing the %MNI of BovII (including duiker) elements from DP2004-014 with the standard food utility index. Note only the high utility bones were used



Gemsbok (Oryx gazella) and medium-large mammal

There is a thoracic vertebrae and a patella, identified to gemsbok representing at least one individual. There is also a patella and 19 long bone shaft fragments identified only to medium-large mammal that could be the long bones of the gemsbok. The lack of crania or toe bones (low utility elements) and the predominance of long bone fragments suggests that the gemsbok underwent primary butchery at another site and the high utility gemsbok bones were brought to DP2004-014 for further processing, probably for bone marrow.

Cape fur seal (Arctocephalus pusillis)

There are 147 bones identified to Cape fur seal, representing five individuals. Most elements are present with the exception of the lowest utility bones, the crania and flippers (Fig. 8.17). As the NISP of the seal sample is greater than one hundred quantitative measures can be applied to identify potential sources of the missing bone. Unfortunately there are no values derived for the density of seal bones, but there is a food utility index. Plotting the %MNI of the high utility elements against the %Modified meat utility index (Savelle *et* *al.* 1996 and based on Metcalf and Jones 1988 standard food utility index) for fur seals suggests a gourmet economic strategy (Fig. 8.18 &Table 8.4). Shannon's evenness index E= 0.383, while Spearman's rho= 0.543, P=0.208, both of which correlate with a gourmet strategy, although there is some modification to the strategy as the Spearman's rho is slightly lower than the expected range (Faith & Gordon 2006). There are at least 3 juveniles, an older immature individual, and an adult male. The juveniles and the immature individual are identified by the fusion of the long bones, while the adult male is identified by the presence of a baculum (penis bone). The presence of an adult male with juvenile seals indicates that the animals were obtained from a rookery, the only place males spend time together with juveniles. Seal pups are born at the end of November and the beginning of December, and copulation begins a week later. Thus, it is possible that the rookery referred to in chapter 5, only 5 km from DP2004-014 was already established. It is also possible to identify the season of occupation of the site, during summer, the only time males, immature yearlings, and pups are together; otherwise males tend to leave the rookery and live at sea.

Figure 8.17 **The distribution of Cape fur seal elements at DP2004-014. The MNI (100%) = 5. Note the lack of skulls**

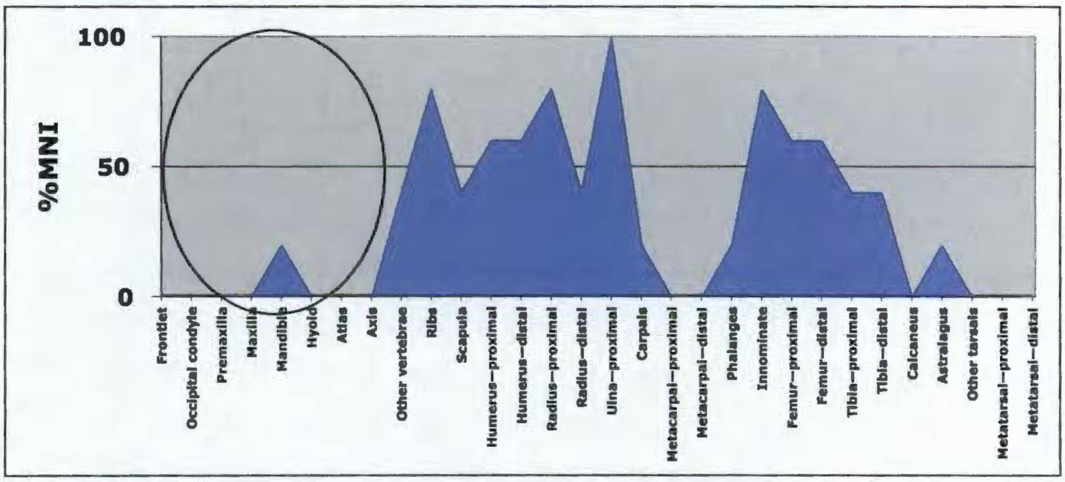
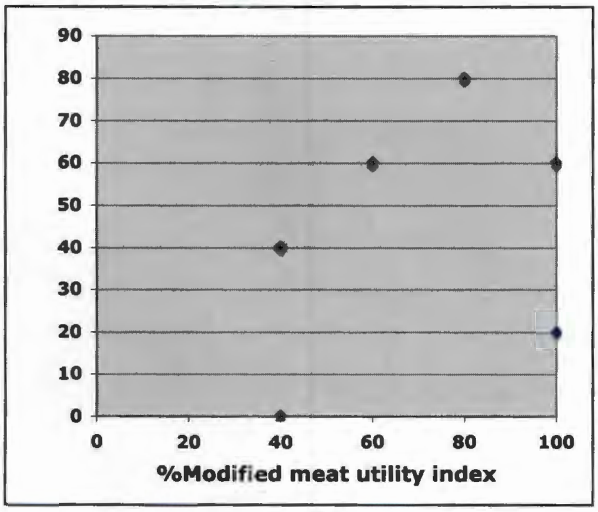


Figure 8.18 **Scatterplot comparing the %MNI of Cape fur seal elements from DP2004-014 with the %Modified meat utility index. Note only the high utility bones were used**



Suricate (Suricatta suricatta)

There are eleven skull bones identified to the small carnivore suricate, representing at least one individual.

Wild cat (Felis lybica)

There are five bones identified to wild cat, representing a minimum of one individual. The elements consist of a left and right humerus, a tibia, an innominate, and a femur. All bones are from an immature individual based on the fusion of the epiphyses, making it likely that that they are, in fact, from the same animal.

Small carnivore

There are eleven bones that could be identified only to small carnivore. The remains consist of fragmented long bones, vertebrae, a rib, and skull bones. It seems probable that these fragments belong to the suricate and/or the wild cat.

Springhare (Pedetes capensis)

There is a single femur identified to springhare.

Brant's whistling rat (Parotomys brantsii)

There are nine elements identified to Brant's whistling rat representing three individuals based on right mandibles. The elements are all skull bones, however it is difficult to identify micromammal post-crania to species.

Otomys/Parotomys sp.

There are four skull bones that could only be identified to *Otomys/Parotomys sp*. consisting of three left mandibles and one right maxilla.

Micromammal sp.

There are thirteen bones that could only be identified to micromammal sp. These bones consist of skull bones, a rib, a humerus, a tibia, and a femur. These represent another three individuals, smaller than the rats.

As the micromammal sample (including the Brant's whistling rat and the unidentified *Otomys/Parotomys sp.*) is dominated by crania, it is likely that humans are responsible for their presence at the site rather than being intrusive or the remains of other predators (Chapter 6, Dewar & Jerardino 2007).

Whale *sp.*

There are no less than 24 fragments of cancellous whale bone. These are heavily fragmented, and it may be that they represent one individual that was scavenged when beached.

Small mammal

There are 478 bones that could only be identified to small mammal. They consist primarily of fragments of long bone shafts, ribs, and vertebrae, but there is also a scapula. The heavy fragmentation makes further identification difficult. It is likely that this category includes the missing small carnivore and springhare bones.

Small-medium mammal

There are 39 bones identified to small or medium mammal, consisting of heavily fragmented long bones, ribs, and vertebrae.

Medium mammal

There are 18 bones identified to medium mammal, consisting of long bone fragments and a few ribs. The most likely source of these bones is the duiker or BovII category.

Ostrich (Struthio camelus)

There are fifteen bones identified to an immature ostrich. The bones consist of a premaxilla (upper beak), a tibiotarsus, a femur, phalanges, a rib, and fragments of long bone.

Medium Aves

There are three bones identified to a medium size bird, the size of a southern black koraan (*Eupodotis afra),* a sternum, a tibiotarsus, and long bone fragments.

Frog

There are three radioulnae, representing a minimum of two frogs at DP2004-014. This is interesting, as frogs require fresh water, indicating that there must have been some nearby.

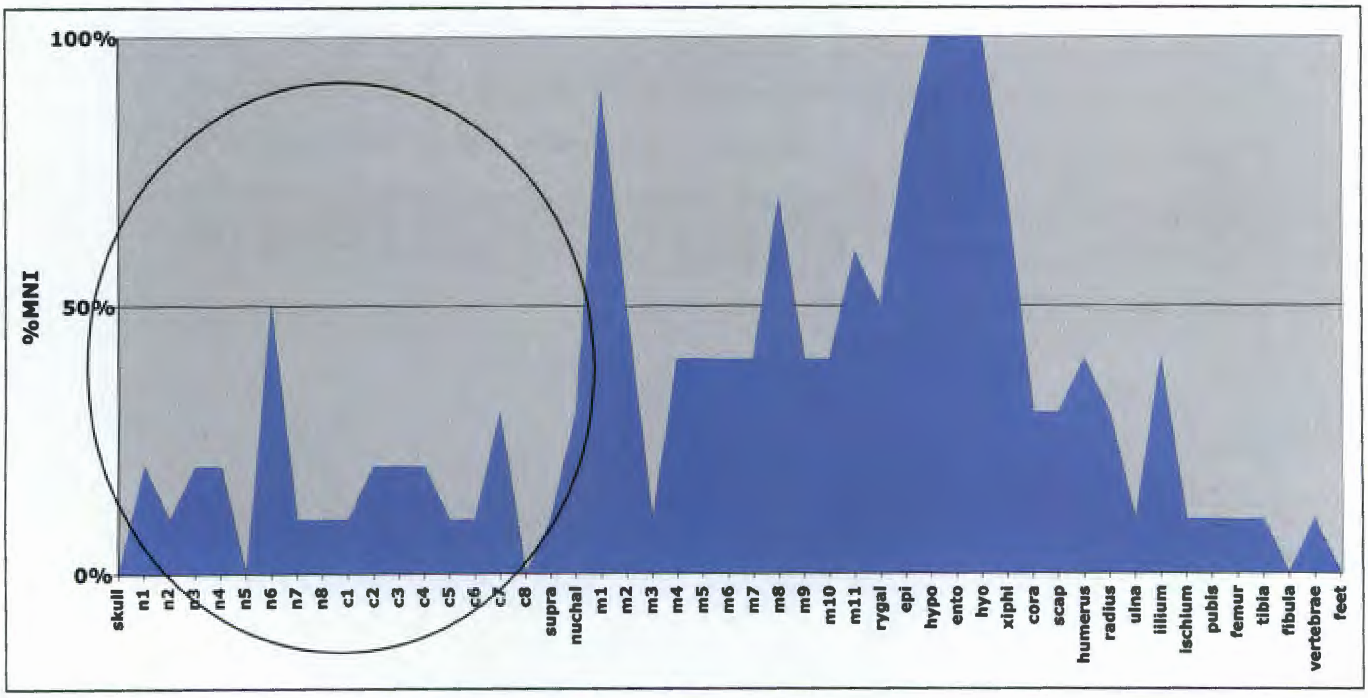
Snakes

There are 12 snake vertebrae with a large spike identifying a large puff adder size snake. There are also 44 ribs and vertebrae from a medium size berg adder size snake. While snakes could have been eaten, they are also a potential source of poison for arrowheads. This is supported by the lack of snake skulls, where the poison is stored. They may well have served both purposes.

Angulate tortoise (Chersina angulata)

There are 327 bones identified to angulate tortoise representing a minimum of ten individuals. There are 89 bones that could be identified only as carapace fragments. All elements are present except for the skulls, the 5th neural, the 8th carapace, the fibulae, and the foot bones (Fig. 8.19). The missing carapace and neural bones were most likely destroyed when processing the animals and are probably within the unidentified carapace fragments. However, the lack of skulls, fibulae, and toes is meaningful. It is probable that the heads were removed and either dumped elsewhere or consumed. The paucity of the tortoise heads is common in other archaeological assemblages from Namaqualand (personal observation). Overall, there is a lack of limb bones including the phalanges. Perhaps these tiny fragile bones are: not being collected in the sieve; they are being consumed; or they were destroyed by fire. Tortoise bone in archaeological assemblages usually shows some sign of heat alteration, at this site, 20 carapace and 9 plastron bones are burnt (Table 8.5). One of the tortoises was found whole, buried beneath the midden but before the midden was established. Most elements of this individual are still articulated with the exception of the missing head and limbs. The plastron is intact and the carapace is burned.

Figure 8.19 **The distribution of angulate tortoise elements at DP2004-014. Note the low percentage of carapace bones shown by the circle. C=carapace, M=marginal, N=neural**



Bone modifications

The number of modifications identified on the bone assemblage is low (Table 8.5). The evidence for human modifications includes cuts marks, heat alteration, and spiral fractures, but none of these categories affects more than 6.6% of the assemblage. This is probably due to the heavy fragmentation of the bone, obscuring identification of all modifications. Evidence of carnivore activity at the site is also low with only 0.3% of the assemblage showing evidence for carnivore gnawing. There are eight bones that exhibit irregular breaks or evidence for being broken well after the bone has dried out (Johnson 1985). Following Behrensmeyer's (1978) weathering stages, there are 29 bones in stage 1 and ten bones in stage 4. The stage 4 bones may have been on the surface since the site was originally occupied while the stage 1 bones were recently exposed to the sun. However, the low frequency of weathered and carnivore gnawed bone suggests that the site was buried rapidly after use.

Table 8.5 Modifications identified on bone from DP2004-014. Tortoise carapaces are burnt more often than the plastrons

	Modification	Cut marks	Burnt	Gnawed	Spiral breaks	Irregular breaks	Weathered	
							Stage 1	Stage 4
Total sample N=4806	No.	69	66	13	315	8	29	10
	%No.	1.4	1.4	0.3	6.6	0.2	0.6	0.2
Tortoise N=327	Carapace		20					
	Plastron		9					

Crayfish (Jasus lalandii)

There are 965 crayfish mandibles and 95 carapace fragments in the assemblage. The MNI is 496 based on right mandibles. The mean length of the right mandibles is 12.9±2.5mm, ranging from 6.0-19.7 mm. The mean length of left mandibles is 12.2±2.3mm, ranging from 7.2-18.6 mm. Converting mandible length to carapace length following Jerardino *et al.* (2001), the average carapace length is 86.4±14.9 mm, ranging from 44.5-126.8mm based on right mandibles and 86.9±14.5 mm, ranging from 55.1-126.8 based on left mandibles.

Shellfish

The large amount of shellfish at the site made sub-sampling necessary. Shellfish from squares N7, N8, M19, and M17c (a total of 3.25m^2) were identified, counted, and where possible measured. The shellfish is dominated by three limpet species, *Cymbula granatina* (70.5%), *Scutellastra granularis* (20.4%), and *S. argenvillei* (6.6%) (Table 8.6). Other species identified in the assemblage include *Conus sp., Oxystele sp., Aulacomya ater, Barnacle sp., Burnapena cincta, Dendrofissurella scutellum,* and *Crepidula fornicata.*

The mean size of the three dominant limpet species is typical for Later Stone Age sites from Namaqualand: *C. granatina* is 47.6±9.6mm, *S. granularis* is 35.5±4.7, and *S. argenvillei* is 65.4±13.7mm (Table 8.7).

Table 8.6 **The shellfish species identified at DP2004-014**

Species	MNI	%assemblage
Cymbula granatina	1486	70.5
Scutellastra granularis	430	20.4
Scutellastra argenvillei	139	6.6
Conus sp.	26	1.2
Oxystele sp.	11	0.5
Aulacomya ater	5	0.2
Barnacle sp.	5	0.2
Burnupena cincta	2	0.1
Dendrofissurella scutellum	1	0.05
Crepidula fornicata	1	0.05
Total	**2106**	**100**

Table 8.7 **The mean length and relevant statistics for the three dominant shellfish species at DP2004-014**

Species	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
C. granatina	202	47.6	9.6	23.4	83.7
S. granularis	245	35.5	4.7	14.8	49.6
S. argenvillei	58	65.4	13.7	18.8	79.6

The three limpet species are commonly found in the inter-tidal zone of rocky headlands and platforms. The dominance of *C. granatina* and *S. granularis* in the assemblage shows that the mid inter-tidal zone was heavily exploited. *S. argenvillei* occupy the low inter-tidal zone and their presence suggests that people were collecting shellfish during or near a spring tide, as this is when this species can be harvested most easily. The lack of *Choromytilus* *meridionalis* is of interest as it is a common shellfish found along the shoreline today and is found in many archaeological sites further south. Overall, the shellfish sample is heavily fragmented, 86% of the *C. granatina* could not be measured (Table 8.7). Most of the remaining shellfish species are small and most likely arrived on the site unintentionally, clinging to the shells of larger limpets. The *Conus* shells must have been purposely collected as beach rolled *Conus* shells are common in archaeological assemblages from Namaqualand, and are usually made into pendants.

Kilojoules

The available kilojoules at DP2004-014 is dominated by marine species at two thirds of the assemblage (Fig. 8.20). Cape fur seal dominates the distribution of kilojoules at 30%, followed by gemsbok at 25%, and *C. granatina* at 16% of the assemblage (Table 8.8 & Fig. 8.21). Shellfish accounts for 23% of the diet.

The kilojoules available from the whale species were not included in this analysis, as it would have overwhelmed the distribution of kilojoules from the other categories and it is unclear if whale was consumed or if the vertebrae were collected for other purposes, eg. sitting stools (cf. Gordon's drawing in Cullinan 2006; Fig. 8.22).

Figure 8.20 **The distribution of marine versus terrestrial kilojoules at DP2004-014**

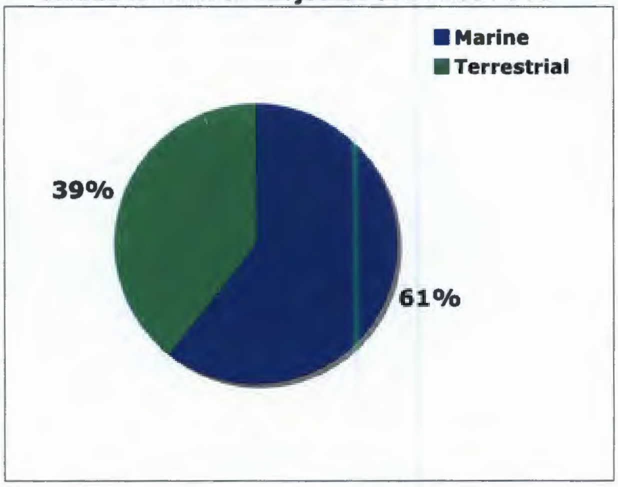


Figure 8.21 **The distribution of kilojoules by species at DP2004-014**

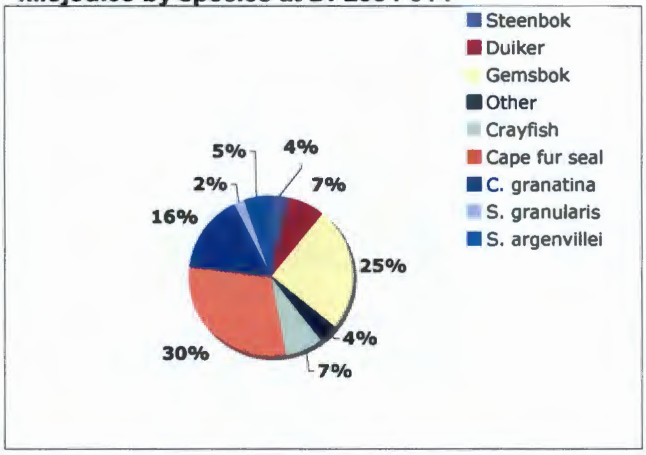


Figure 8.22 **A drawing from Gordon's travels showing people near the Orange River mouth Namaqualand, using whale bone as sitting stools and as a frame for their huts. Taken from Cullinan (2006)**

Table 8.8 **The distribution of kilojoules at DP2004-014**

Species		KJ/individual	Number of individuals	Total kilojoules
Steenbok	adult	47,000	1	47,000
	immature*	28,200	2	56,400
BovII (incl. duiker)	adults	82,740	2	165,480
	immature*	49,644	1	49,644
Gemsbok		725,700	1	725,700
Springhare		9,800	1	9,800
Cape fur seal	adult male	721,825	1	721,825
	Immature*	99,000	1	99,000
	juveniles	16,500	3	49,500
Suricat		3,920	1	3,920
Wild cat	immature*	13,224	1	13,224
Ostrich	immature*	32,400	1	32,400
Medium aves		10,000	1	10,000
Frog		1,000	2	2,000
Large snake		2,000	1	2,000
Medium snake		1,000	1	1,000
Angulate tortoise		2,000	10	20,000
Rat (incl. Brant's whistling)		1,400	5	7,000
Micromammals		1,000	3	3,000
Crayfish		436.6	496	216,553
C. granatina		16	28,348	453,568
S. granularis		8	8,203	65,624
S. argenvillei		58.3	2,652	154,612

*Assume immature individuals are 60% adult size. Whale is not included, as it would overwhelmingly dominate the distribution of kilojoules.

Discussion and conclusion

DP2004-014 is located on top of a large dune ridge on the eastern edge of a large dune sea or sand transport corridor 2.3km inland and 6.6km north of the Buffels River. The site is in a slight deflation hollow surrounded by many hummocks, or dune mounds stabilized by local vegetation. The midden consists of 5.8m^3 of material in two tongues, a north and a south one with two ash patches on the west side of the south tongue. The single occupation layer has a calibrated radiocarbon date of 1462AD. The north tongue seems to be the refuse of the activities of a woman or women, as this is where large number of unfinished beads and modified shells are most dense. The southern tongue seems to be the refuse pile of men's activities as this is where the majority of the lithics are concentrated. There is also an area in the centre of the site, which may have been the actual work area or the position of a shelter. The concentration of finished and worn ostrich eggshell beads in the centre, suggests that beads were left where they fell, potentially while someone worked on bone tools.

The stone artefacts are non-formal or an expedient assemblage of ad hoc large flakes made primarily on milky quartz. There is a single formal tool, a broken backed point made on milky quartz. All the raw materials are local, with the exception of the few cryptocrystalline silicate and quartz crystal chips and chunks, whose sources are unknown, but may be local. The presence of multiple hammerstones, cores, chips, and chunks suggests that the lithics were processed on site. The presence of both lower and upper grindstones suggest that some form of grinding activity occurred on site, although there is no indication of what was being ground (i.e. there is no evidence of bulbs, seeds, ochre, or specularite).

There is a range of non-lithic artefacts at the site including a pottery rim, ostrich eggshell beads in various forms of manufacture, bone tools, and modified shellfish. The relatively large number of artefacts in various stages of manufacture suggests that this may be an aggregation site (cf. Wadley 1987) but it was at least a temporary base camp (cf. Jerardino 1995).

The subsistence strategy at DP2004-014 seems focussed primarily on the nearby Cape fur seal rookery, as seals provide the most kilojoules. The presence of an adult male, an immature individual, and three juveniles suggests that the rookery was exploited during the mating season or early summer, when these three categories of seal would be together at the nursery. The economic strategy identified for the seals is gourmet, where people were returning to the site with only the best cuts of meat and leaving the bulk of the low utility elements at the kill site. This strategy was also applied to some of the steenbok and BovII, although some individual bovids were brought to the site as whole carcasses. While the gemsbok sample size is too small to apply quantitative measures, the presence of only high utility bones suggests that only the best cuts of gemsbok were brought to the site. Overall this suggests that DP2004-014 is a processing site, where seal was the primary resource. Also of importance to the diet is the large number of crayfish. Like shellfish, each individual contributes a relatively small number of kilojoules, but together shellfish and crayfish are a rich predictable resource when mass harvested (Dewar *et al.* 2005, Madsen & Kirkman 1988, Madsen & Schmitt 1998).

There is a high frequency of juveniles and immature individuals at the site, although this is most likely due to the timing of the site's occupation, during the early summer, after the rainy season. The presence of a range of species indicates that the diet was broad, although the smaller species are present in such small percentages, that they may just be opportunistic additions to the subsistence strategy. In addition, some species may have been collected for other purposes: the snakes could have been collected for their poison. A note should be made regarding the whale bone as there is no direct evidence (such as the presence of whale barnacles) that whale meat or blubber was consumed at the site. In fact, the whale bone may actually have been brought to the site as furniture (cf. Cullinan 2006 and Binford 1981). However, if people were consuming whale at DP2004-014, the available kilojoules would be overwhelmingly dominated by marine species in the subsistence strategy.

The shellfish data contributes more than just kilojoules to the interpretation of the DP2004-014. The presence of *C. granatina* and *S. granularis* identify the intensive exploitation of the mid inter-tidal zone, while the *S. argenvillei*, who live in the low inter-tidal zone, identify the exploitation of a spring low tide. The lack of *C. meridionalis* is interesting as they are common in many sites further south.

Chapter Nine: KN6-3C

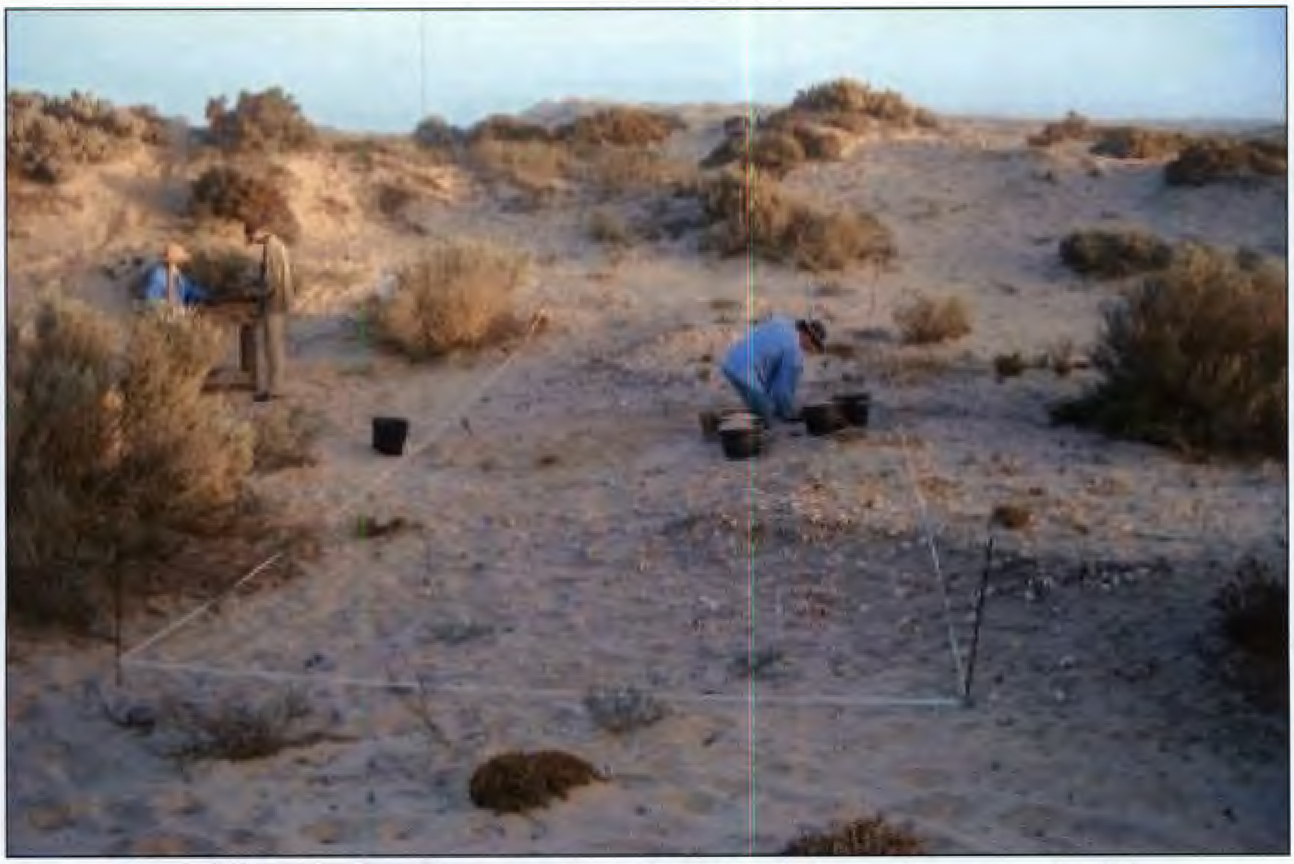


Figure 9.1 **Facing north, the excavation of KN6-3C with Jayson Orton in square J13**

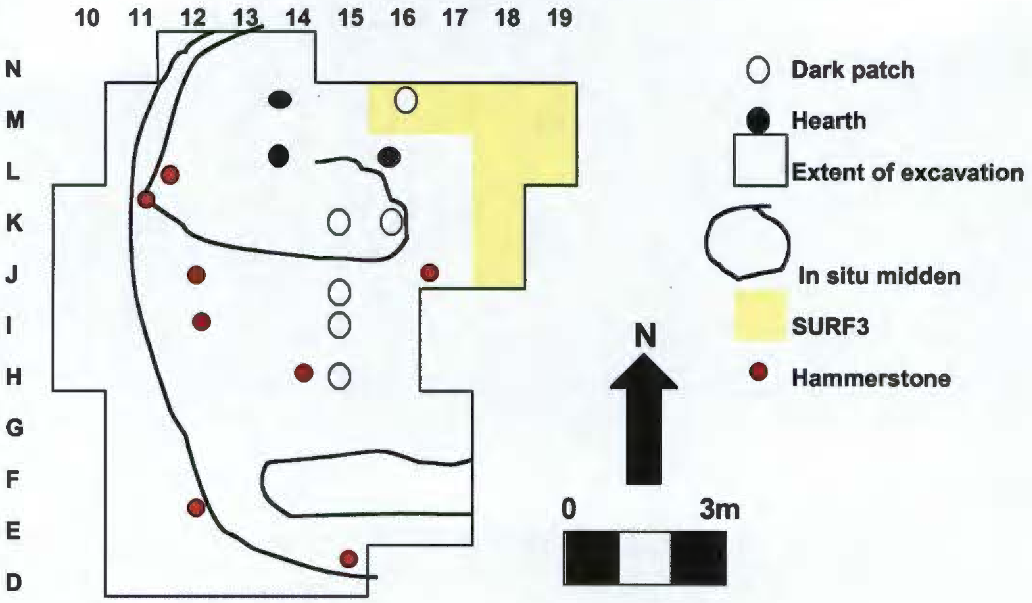
Introduction

The site of KN6-3C consists of two patches of in situ shell midden within a sandy deflation zone, a few meters north of an old prospecting trench in the Koignaas Complex of the De Beers Namaqualand Mine (30° 13' 18.9" S 17° 14' 17.9" E) (Fig. 1.5). The nearest perennial river is the Swartlinjies, 5km to the south, while a large rocky headland lays 160m to the west, on the Atlantic Ocean (Fig. 1.5). The site was identified in 2001 by the Archaeology Contracts Office during an intensive survey program, identifying archaeologically sensitive areas within the De Beers Namaqualand Mine. KN6-3C was first detected as a thin lens in the upper part of the old prospecting trench. The initial survey identified the presence of stone drills/borers at KN6-3C as well as a suite of bone, crayfish mandibles and shellfish, so the site was excavated in 2003.

Excavation

The site was excavated in 78 units of 1m^2. A total of 7.6m^3 of shell midden and archaeological material (Fig. 9.2) was recovered. Standard methods of excavation were employed, using a trowel, pans, buckets, a 1.5mm sieve, and 3mm sieve. KN6-3C was excavated stratigraphically and has at least two occupation layers (Fig. 9.3).

Figure 9.2 Plan of KN6-3C

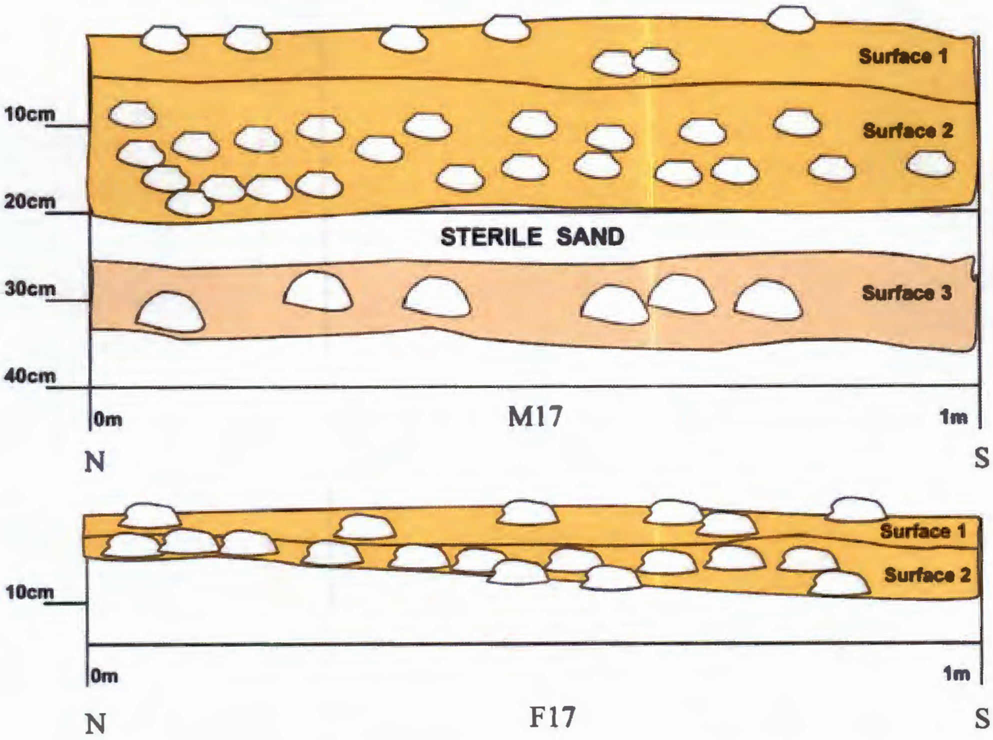


Stratigraphy

The surface of the site is 12m in diameter. Excavation revealed two discrete areas of in situ shell midden. 13m^2 was excavated from the northern midden and 4m^2 was excavated from the southern midden (Fig. 9.2).

In the excavation of the in situ middens, three layers could be distinguished. The layer surface 1 consists primarily of limpet shells of varying density within loose pale yellow sand. This layer is present across the site, in both patches and ranges from 3-8cm in depth (Fig. 9.3). The second layer surface 2 consists of in situ shell midden dominated by limpet shells with a matrix of dark sand. Layer surface 2 is also found across the site in both patches and ranges from 8-16cm in thickness (Fig. 9.3). Beneath surface 2 is a sterile sand layer. The third archaeologically relevant layer, surface 3, consists primarily of large *Scutellastra argenvillei* limpets within a white sand matrix and is restricted to the northeastern corner of the northern midden with a thickness of 8-12 cm (Fig. 9.3).

Figure 9.3 **Schematic profile of KN6-3C. The top profile is from the northern midden, along the intersection of rows M16 and M17. The bottom profile is from the southern midden, along the intersection of rows F16 and F17**



The deflated surface material, layers surface 1 and surface 2 are very likely the remains of the same occupation event. The core of the middens are maintained and identified as layer surface 2 with dense compact shells and preservation of the organic component of the midden, hence the darker matrix. The layer surface 1 probably consists of the same material churned up through bioturbation. The earliest occupation event is preserved in layer surface 3, a distinct layer dominated by a single species of shellfish, separated from the deposits above by a sterile lens of sand. This occupation event covers a much smaller area, only 8m$^{2.}$ This pattern is more typical of shell middens from Namaqualand.

The analysis of the artefacts supports this grouping of the layers and so it is more meaningful to discuss the site as two occupation events, rather than four layers. For the analysis, the surface deflation, surface 1 and surface 2 will be referred to as the second occupation event surface1&2, while the first occupation of the site will be referred to as surface 3.

Features

There are three hearths at KN6-3C located within the second occupation surface 1&2, in the northern midden (Fig. 9.2). They are all roughly circular ranging from 35-40cm in diameter. There are another six smaller ash patches or dumps, three of which are in the northern midden, while the remaining three patches are between the two middens.

Radiocarbon dates

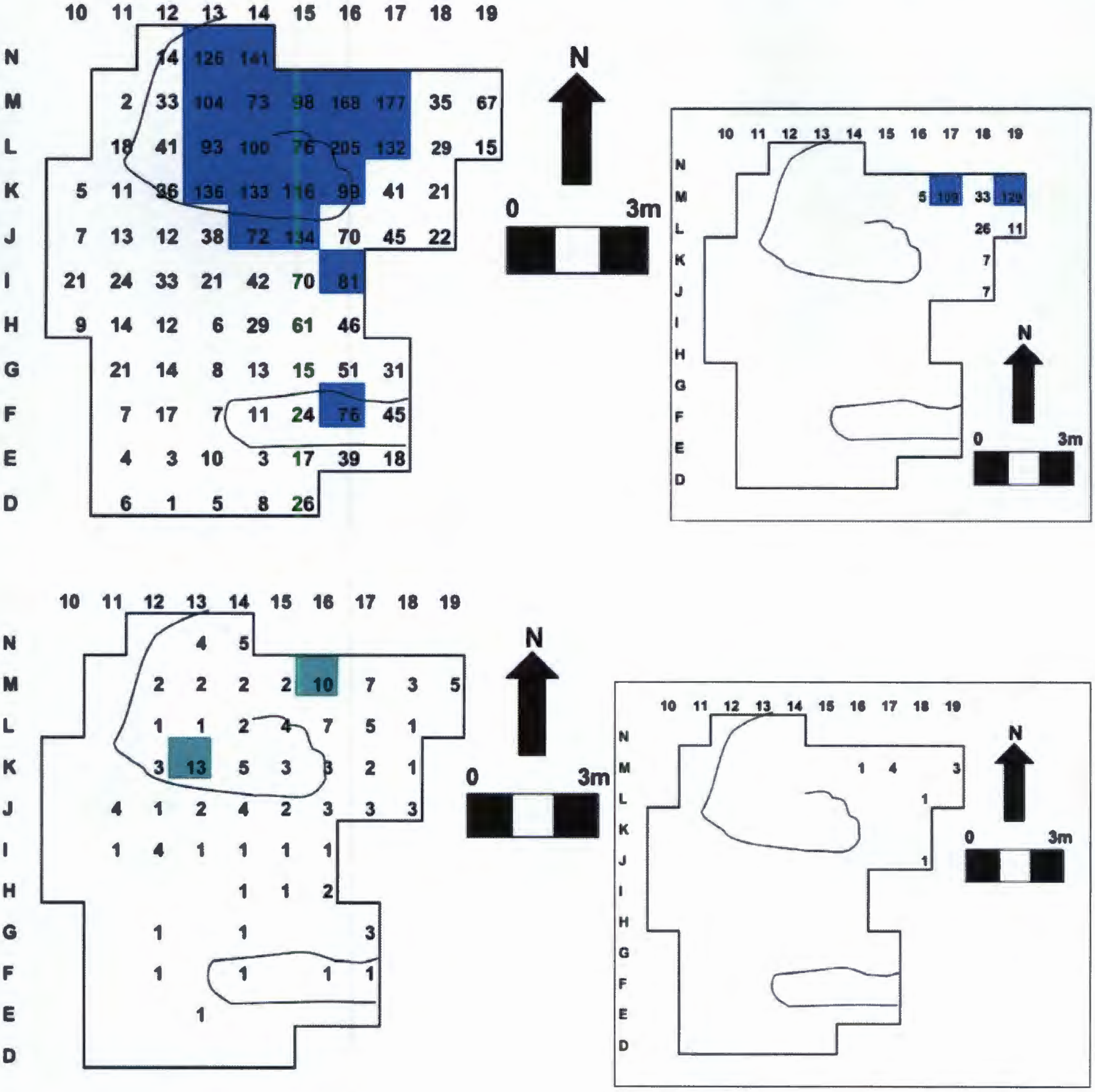
Three radiocarbon dates were obtained on marine shellfish, two from the north midden and one from the south midden. The north midden dates are both from the square M18, one from layer surface 3 and one from layer surface 1. The south midden date is from surface 1 of square F16. The radiocarbon date from surface 3 of M18 is 4630±70BP (Pta-9316) with a calibrated radiocarbon date of 2684BC (2845-2582 BC). The radiocarbon date for surface 1 of M18 is 3740±60BP (Pta-9325) with a calibrated radiocarbon date of 1509BC (1594-1440BC). The radiocarbon date for surface 1 from F16 is 3720±45BP (Pta-9335) with a calibrated radiocarbon date of 1496 BC (1526-1435 BC). The two surface 1 dates are consistent with a single event linking the two patches to the same deposition event at roughly 1500BC, while the lowest layer produced a second occupation event at roughly 2684BC.

Spatial distribution of archaeological material

The archaeological remains present at KN6-3C include stone, ostrich eggshell body fragments and beads, bone beads and refuse, crayfish, and shellfish. As the first occupation midden is relatively limited in extent, it is difficult to make observations regarding the distribution of finds from that layer. Thus the majority of the comment on spatial distribution of artefacts will be focussed on the second occupation, surface 1&2.

The stone assemblage is distributed across the site, but the northern midden has the highest concentrations of lithic material (Fig. 9.4).

Figure 9.4 **The distribution of lithics at KN6-3C. The values indicate the number of lithic artefacts present per m^2. The left map shows the second occupation surface 1&2, while the right map shows the first occupation surface 3. Blue squares highlight the area of dense concentration. The bottom most maps show the distribution of the formal tools**



	10	11	12	13	14	15	16	17	18	19
N			14	126	141					
M		2	33	104	73	98	168	177	35	67
L		18	41	93	100	76	205	132	29	15
K	5	11	36	136	133	116	99	41	21	
J	7	13	12	38	72	134	70	45	22	
I	21	24	33	21	42	70	81			
H	9	14	12	6	29	61	46			
G		21	14	8	13	15	51	31		
F		7	17	7	11	24	76	45		
E		4	3	10	3	17	39	18		
D		6	1	5	8	26				

	10	11	12	13	14	15	16	17	18	19
N										
M							5	109	33	129
L									26	11
K									7	
J									7	
I										
H										
G										
F										
E										
D										

	10	11	12	13	14	15	16	17	18	19
N				4	5					
M			2	2	2	2	10	7	3	5
L			1	1	2	4	7	5	1	
K			3	13	5	3	3	2	1	
J		4	1	2	4	2	3	3	3	
I		1	4	1	1	1	1			
H					1	1	2			
G			1		1			3		
F			1		1		1	1		
E				1						
D										

	10	11	12	13	14	15	16	17	18	19
N										
M							1	4		3
L									1	
K										
J									1	
I										
H										
G										
F										
E										
D										

Figure 9.5 The distribution of ostrich eggshell at KN6-3C. The values are numbers of body fragments per square. The left map shows the second occupation surface 1&2, while the right map shows the first occupation surface 3. Orange highlights areas of dense concentration with values greater than 15 fragments per square. The bottom maps show the distribution of ostrich eggshell beads

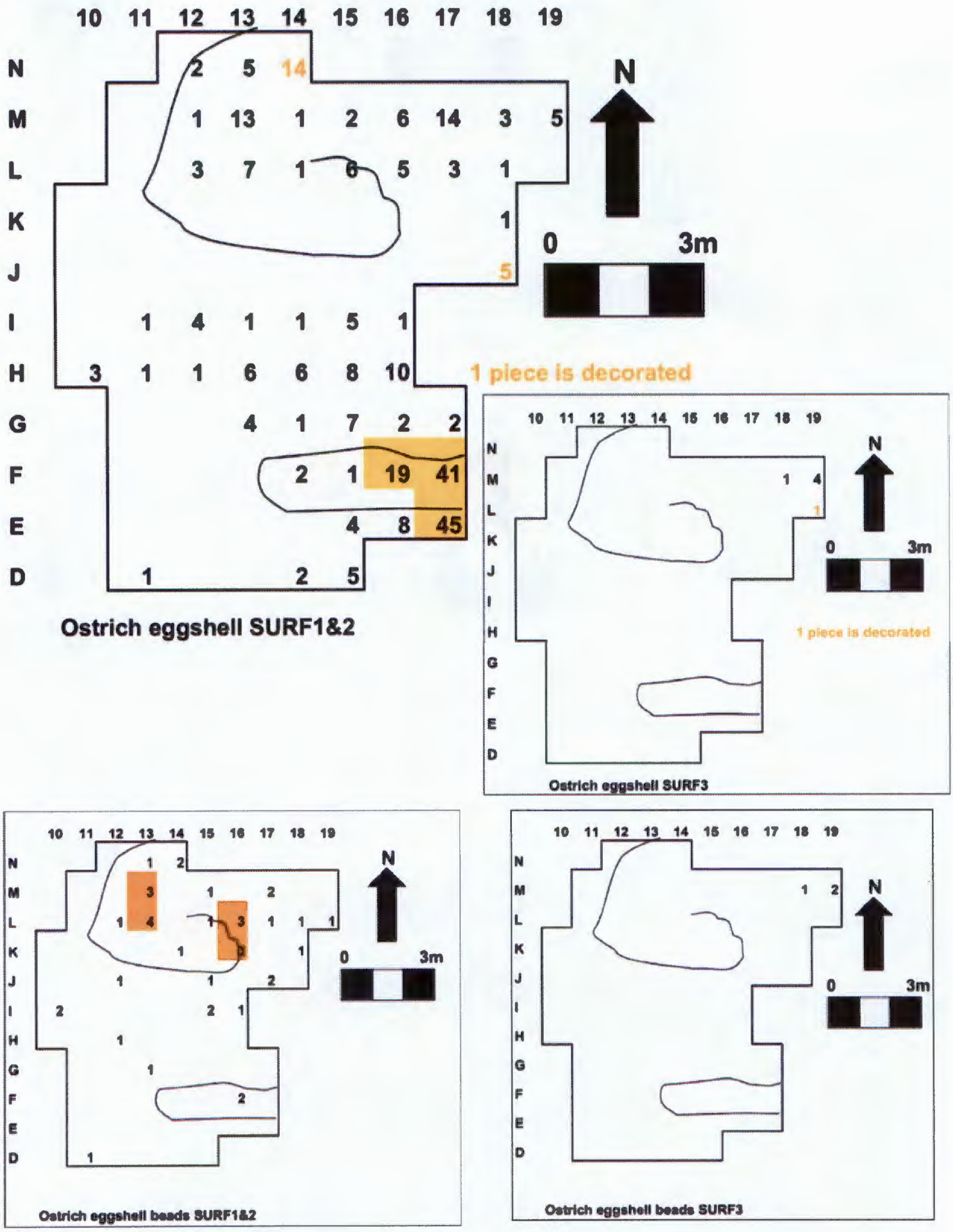


Figure 9.6 The distribution of bone at KN6-3C. The values are number of bones per square. Green highlights areas of dense concentration with values greater than 90 bones per square. The left map shows the second occupation surface 1&2, while the right map shows the first occupation surface 3. The bottom map shows the distribution of the bone beads, only found in surface 1&2

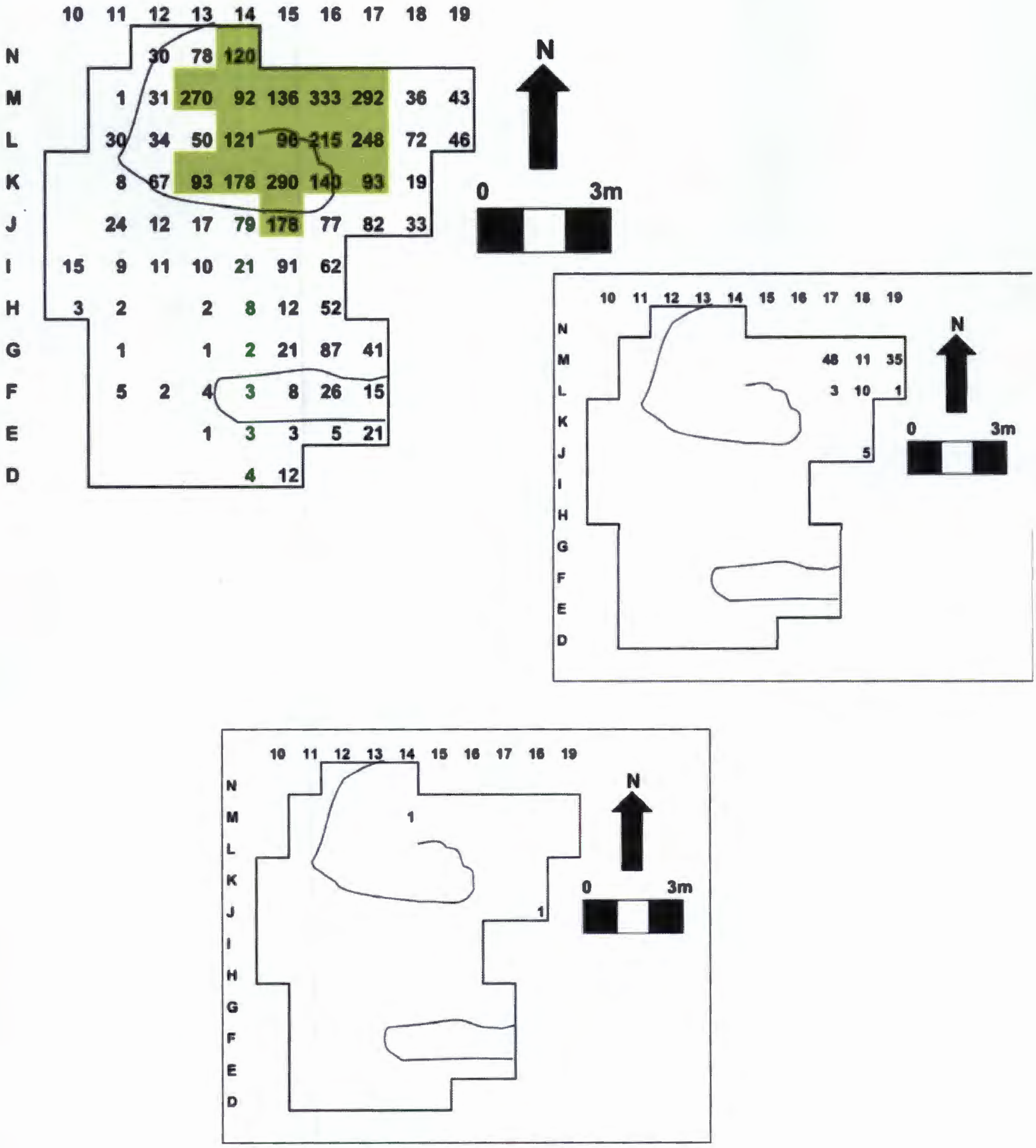
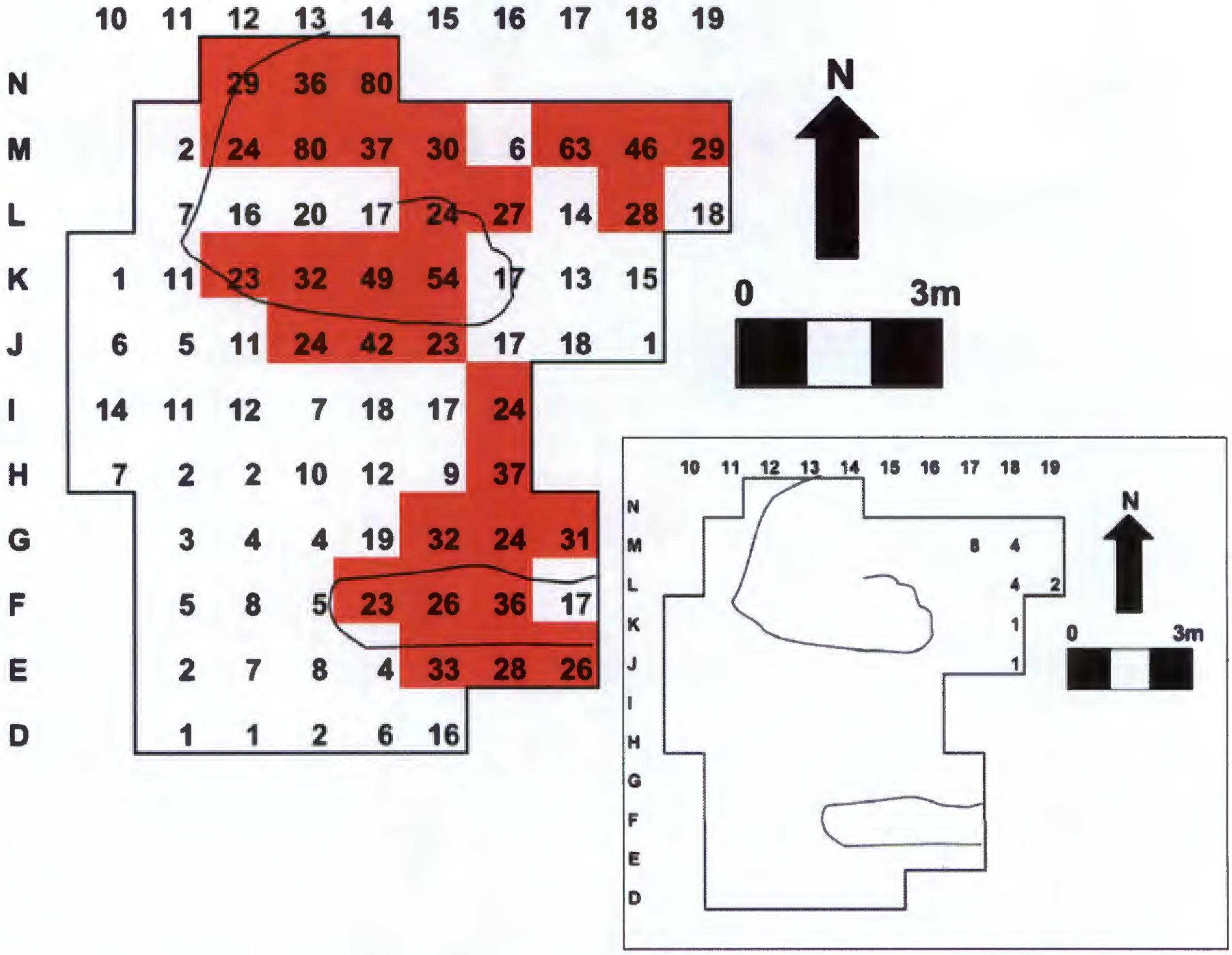


Figure 9.7 **The distribution of crayfish at KN6-3C. The values are the number of mandibles per square. Red highlights the areas of dense concentration with values greater than 20 mandibles per square. The map on the left shows the second occupation surface 1&2, while the map on the right shows the first occupation surface 3**



	10	11	12	13	14	15	16	17	18	19
N			29	36	80					
M		2	24	80	37	30	6	63	46	29
L		7	16	20	17	24	27	14	28	18
K	1	11	23	32	49	54	17	13	15	
J	6	5	11	24	42	23	17	18	1	
I	14	11	12	7	18	17	24			
H	7	2	2	10	12	9	37			
G		3	4	4	19	32	24	31		
F		5	8	5	23	26	36	17		
E		2	7	8	4	33	28	26		
D		1	1	2	6	16				

	10	11	12	13	14	15	16	17	18	19
N										
M								8	4	
L									4	2
K									1	
J									1	
I										
H										
G										
F										
E										
D										

Formal tools are also concentrated in the northern midden, and the large number of lithic waste pieces may reflect formal tool manufacturing processes that took place here.

Fragments of ostrich eggshell are distributed in two patches, corresponding more or less to the two areas of in situ midden, however, the densest concentration of ostrich eggshell fragments is located within the southern midden (Fig. 9.5) The ostrich eggshell beads on the other hand, are more frequent in the northern midden (Fig. 9.5)

The bone assemblage is spread across both middens, but is heavily concentrated in the northern midden (Fig. 9.6). The bone beads are also located in the northern midden (Fig. 9.6).

The crayfish mandibles are distributed across the entire site with two concentrations, one in each midden and a strip linking the two at the western edge of the site (Fig. 9.7). However, the densest concentration with 80 mandibles or roughly 40 individuals per m^2, is located in the northern midden (Fig. 9.7).

The entire shellfish sample was collected and returned to the University of Cape Town. For this analysis however, a sub-sample was used. Thus, there is no data on the distribution of the shellfish. That will be a future honours degree project as the sample is enormous.

Lithics

Table 9.1 Lithic raw materials at KN6-3C

Stone	**Surface 1&2**		**Surface 3**	
	No.	%No.	No.	%No.
Quartz crystal	2,605	70.1	167	51.1
CCS	1,039	27.9	158	48.3
Other (igneous)	26	0.7	0	0
Ochre	22	0.6	1	0.3
Quartzite	16	0.4	0	0
Sandstone	6	0.2	1	0.3
Total	**3,714**		**327**	

The lithic assemblage was identified by Jayson Orton and consists of a total of 4,041 artefacts. Raw materials at the site consist of quartz crystal, cryptocrystalline silicate (CCS), an igneous rock, ochre, quartzite, and sandstone. Most of these materials are known to be local, but the source of the CCS and the ochre is unknown. Quartz crystal and quartzite are readily available. There is a range of formal tools, including scrapers and backed artefacts as well as grindstones, debitage, utilised or edge-damaged material, hammerstones, and manuports. Overall, the formal tools are made on fine-grained material, while the larger artefacts such as hammerstones and grindstones are made on coarse stone.

Starting with the first occupation from surface 3, the assemblage consists of 327 artefacts and is dominated by quartz crystal (51.1%), closely followed by cryptocrystalline silicate (CCS) at 48.3%, with a piece of ochre and a sandstone flake making up the rest of the assemblage (Table 9.1). There are ten CCS formal tools (3.4%), consisting of a thumbnail scraper, three sidescrapers, a backed flake, a borer or drill fragment and four miscellaneous retouched pieces (Fig. 9.8).

Figure 9.8 **Selected lithics from KN6-3C. Top row: CCS thumbnail scrapers. Middle row: CCS backed scrapers on either side of a quartz crystal backed bladelet. Bottom row: CCS sidescrapers. All artefacts except the quartz crystal backed bladelet are from surface1&2, the bladelet is from surface3**

Table 9.2 **The fine-grained material lithic assemblage at KN6-3C**

Stone	**Surface 1&2**		**Surface 3**	
Quartz crystal	**No.**	**%No.**	**No.**	**%No.**
Sidescraper	1	0.03		
Backed scraper	1	0.03		
Backed flake	1	0.03		
Backed bladelet	1	0.03	1	0.3
Backed point	3	0.08		
Segment	4	0.1		
Borer/drill	2	0.05		
MBP	2	0.05		
MRP	2	0.05		
Formals sub total	**17**	**0.5**	**1**	**0.3**
Edge damaged bladelet	2	0.05		
Edge damaged flake	22	0.6		
Edge damaged chunk	2	0.05		
Edge damaged chip	2	0.05		
Edge damaged sub total	**28**	**0.8**		
Blade	6	0.2		
Bladelet	26	0.7		
Flake	543	14.6	24	7.3
Chunk	319	8.6	19	5.8
Chip	1623	43.7	121	37.0
Debitage sub total	**2517**	**67.8**	**164**	**50.2**
Upper grindstone	1	0.03		
Grindstone sub total	**1**	**0.03**		
Bipolar core	12	0.3		
Single platform core	3	0.08	1	0.3
Irregular core	23	0.6	1	0.3
Cores sub total	**39**	**1.1**	**2**	**0.6**
CCS				
Sidescraper	12	0.3	3	0.9
Backed scraper	12	0.3		
Thumbnail scraper	5	0.1	1	0.3
Double sided scraper	1	0.03		
Backed flake	5	0.1	1	0.3
Backed bladelet	11	0.3		
Backed point	3	0.08		
Borer/drill	41	1.1	1	0.3
Segment	2	0.05		
MBP	15	0.4	4	1.2
MRP	14	0.4		
Formals sub total	**124**	**3.3**	**10**	**3.1**
Edge damaged bladelet	1	0.03		
Edge damaged flake	20	0.5	1	0.3
Edge damaged chunk	6	0.2		
Edge damaged chip	3	0.08		
Edge damaged sub total	**30**	**0.8**	**1**	**0.3**
Blade	2	0.05		
Bladelet	13	0.4		
Flake	252	6.8	17	5.2
Chunk	99	2.7	5	1.5
Chip	502	13.5	125	38.2
Debitage sub total	**868**	**23.4**	**147**	**44.9**
Bipolar core	12	0.3		
Single platform core	1	0.03		
Irregular core	4	0.1		
Cores sub total	**17**	**0.5**		

In addition, there is a quartz crystal backed bladelet (Table 9.2). The debitage accounts for 95.1% of the assemblage and includes flakes, chunks, and chips from both quartz crystal and CCS. Utilised pieces at 0.3% of the assemblage consist of a single CCS edge-damaged flake. Cores account for 0.6% of the assemblage and consist of a single platform and an irregular core both made of quartz crystal. The presence of formal tools, debitage, and cores suggests the manufacturing of formal tools took place on site.

The second occupation from surface 1&2 is more varied in raw materials and tool forms (Tables 9.1 & 9.2). The assemblage consists of 3,714 artefacts with quartz crystal dominating the assemblage (71.1%), followed by CCS, igneous rock, ochre, quartzite, and sandstone (Table 9.1). There are 141 formals tools accounting for 4.1% of the assemblage, made on both quartz crystal and CCS, however the dominant formal tool material is CCS at 124 tools, or 87.9%. The scrapers consist of sidescrapers, backed scrapers, and miscellaneous retouched pieces in both quartz crystal and CCS and thumbnail scrapers, sidescrapers, backed scrapers, and a double sided scraper in CCS. Backed artefacts include flakes, points, bladelets, segments, miscellaneous backed pieces, and borer/drill fragments in both quartz crystal and CCS.

Utilised pieces account for 1.7% of the assemblage and consist of edge-damaged flakes, bladelets, chunks, and chips in both quartz crystal and CCS. Debitage includes flakes, blades, bladelets, chunks, and chips accounting for 92.0%. Cores make up 1.6% of the assemblage and consist of bipolar, single platform, and irregular forms, in both quartz crystal and CCS.

There is also a single upper grindstone made of quartz, which is unusual as upper grindstones are generally made on coarser-grained materials.

The coarse grained material in the assemblage (Table 9.3) were used to make eight hammerstones, four upper grindstones, and two lower grindstones. There are also a few flakes, chunks, and chips or debitage in the coarse material category. There are also seven manuports and 22 ochre nodules with no obvious use wear. However, the irregular quartz crystal core is smeared with ochre and the sandstone lower grindstone has evidence of ochre residue.

Table 9.3 **The coarse-grained material lithic assemblage at KN6-3C**

Stone	Surface1&2		Surface 3	
Other (igneous)	**No.**	**%No.**	**No.**	**%No.**
Flake	8	0.2		
Chunk	3	0.08		
Chip	4	0.1		
Debitage sub total	**15**	**0.4**		
Upper grindstone	1	0.03		
Lower grindstone	1	0.03		
Hammerstone/upper grindstone	1	0.03		
Hammerstone	3	0.08		
Hammerstone/grindstone sub total	**6**	**0.2**		
Manuport	**5**	**0.1**		
Quartzite				
Flake	3	0.08		
Chunk	7	0.2		
Chip	4	0.1		
Debitage sub total	**14**	**0.4**		
Hammerstone	1	0.03		
Hammerstone/upper grindstone	1	0.03		
Hammerstone/grindstone sub total	**2**	**0.05**		
Sandstone				
Flake	1	0.03	1	0.3
Debitage sub total	**1**	**0.03**	1	0.3
Hammerstone	1	0.03		
Hammerstone/ upper grindstone	1	0.03		
Lower grindstone	1	0.03		
Hammerstone/grindstone sub total	**3**	**0.08**		
Manuport	**2**	**0.05**		
Ochre				
Nodules	22	0.6	1	

The presence of formal tools, debitage, and hammerstones suggests that stone tools were manufactured at the site. In particular, there are 27 borers/drills and another 14 fragmented borer/drills suggesting that they were the primary formal stone tools being made in the second occupation of KN6-3C.

In addition, the large number of grindstones suggests that some grinding activity occurred at the site.

Ostrich eggshell

Fragments

There are a total of 295 fragments weighing 273.1g. The first occupation surface 3 has only six fragments of ostrich eggshell weighing 9.7g. One is decorated with multiple parallel lines incised into the fabric of the eggshell (Fig. 9.9).

Figure 9.9 **The decorated ostrich eggshell from KN6-3C. Top: single decorated piece of ostrich eggshell identified in surface3. Middle and Bottom: Two decorated pieces of ostrich eggshell from surface1&2**

The second occupation surface1&2 has a total of 289 fragments weighing 263.4g. There are eight flask mouth fragments, identified by having a ground edge and oblique angle of breakage in the interior of the aperture. In addition, there are two decorated pieces; one is slightly burnt with three parallel lines filled with strings of triangles, all done through incision (Fig. 9.9). The second decorated piece is much smaller with one incised line (Fig. 9.9).

The evidence for taphonomic processes experienced by the eggshell include heat alteration on 21 pieces, wind erosion on 37 pieces, and one piece has a canine puncture from a small carnivore. A further 20 pieces have particularly deep egg breathing holes, but their depth is most likely related to exposure to the wind.

Beads

There are a total of 43 beads with 40 stage 11, complete beads (Kandel & Conard 2005). There are also two stage 12 broken complete beads and a single stage 5, completely perforated but not yet rounded bead. All beads are found in surface1&2. The average external diameter is 4.2±0.5mm with a range of 2.9-5.3mm (Figs. 9.10 & 9.11). The average aperture is 1.7±0.4mm with a range of 1.2-2.5mm (Fig. 9.11). The majority of the beads have evidence for wear, 35 beads have wear facets, twelve have become oblong due to wear, and in twenty-nine beads, and the aperture is no longer in the centre of the bead. In addition, five beads are burnt and one is covered in ochre.

Figure 9.10 **A bar graph of the ostrich eggshell beads external diameters in mm**

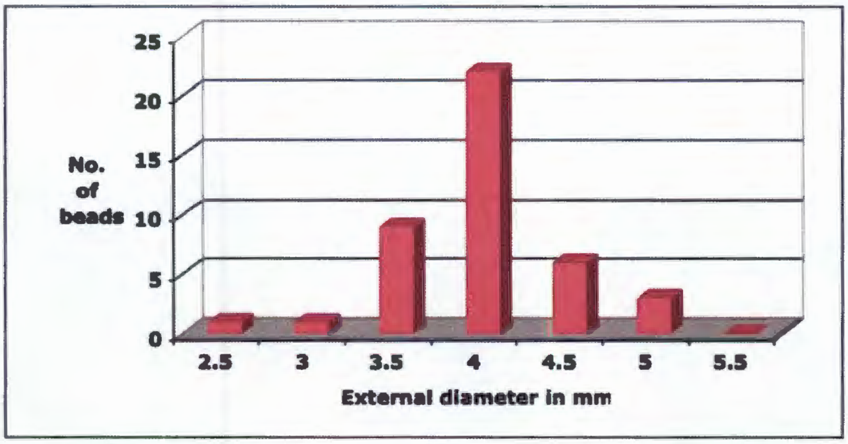
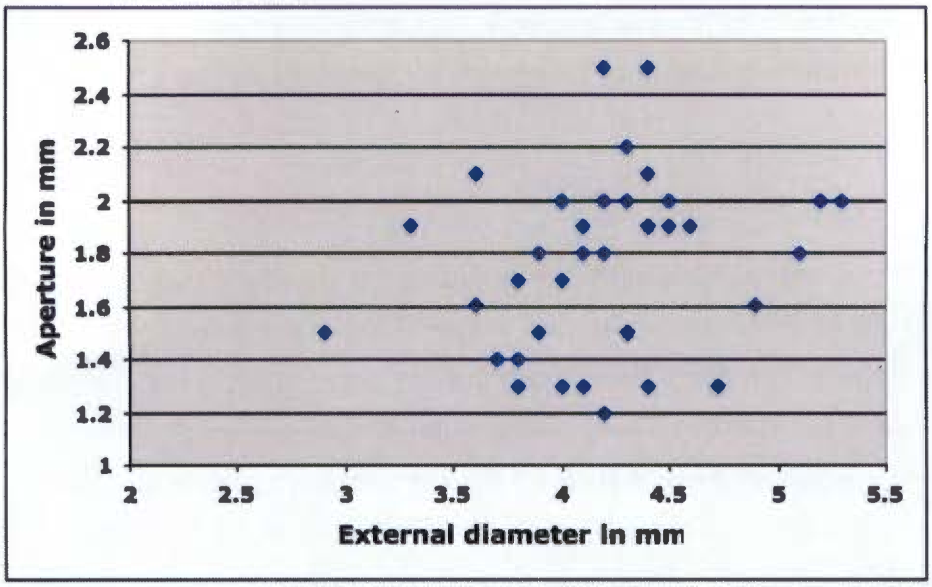


Figure 9.11 The external diameter versus the aperture diameter of the ostrich eggshell beads at KN6-3C



Bone

Beads

Two broken bone beads were identified in the surface1&2 assemblage. They are 2.4mm thick with an external diameter of 9.1mm. The estimated aperture is 3.3 and 3.1mm. While they were found near each other and are nearly identical in size, they do not fit together (Fig. 9.12).

Figure 9.12 The bone beads from KN6-3C

Subsistence strategy

Surface 3

The first occupation surface 3 has a total of 80 bones weighing 22.3g, with 30 (37.5%) identified to species or size class (Table 9.4). The species present in this layer includes a male steenbok, an angulate tortoise, a snake, a lizard, a small mammal, a Brant's whistling rat, and a micromammal. This is a moderate sample of available species in the region.

Table 9.4 The identified vertebrate species at KN6-3C

Taxon		**Surface 1&2**		**Surface 3**	
		NISP	MNI	NISP	MNI
Steenbok	*Raphicerus campestris*	81	3	1	1
Bovid size class II		6	3		
Cape hare	*Lepus capensis*	3	1		
Wild cat	*Felis lybica*	3	1		
Bat eared fox	*Otocyon megalotis*	3	1		
Cape fur seal	*Arctocephalus pusillus*	14	1		
Medium carnivore		2	1		
Brant's whistling rat	*Otomys brantsii*	2	1	1	1
Rock elephant shrew	*Elephantulus edwardii*	5	3		
Micromammals		44	4	8	1
Small mammal		473	/	4	1
Medium mammal		10	1		
African penguin	*Spheniscus demersus*	4	2		
Medium aves		1	1		
Large aves		1	1		
Angulate tortoise	*Chersina angulata*	458	8	10	1
Lizard		10	5	2	1
Medium snake		19	1	4	1
Fish		3	1		
Total		**1142**	**40**	**30**	**7**

Steenbok (Raphicerus campestris)

There is a frontlet with a horn core identified to steenbok.

Brant's whistling rat (Otomys brantsii)

There is one incisor identified to Brant's whistling rat.

Micromammal sp.

Eight elements were identified only to micromammal species, representing at least one individual. Elements consisted of three incisors, a molar, a maxilla, a mandible, a vertebra, and a long bone shaft fragment.

Small mammal

Four elements were identified only to small mammal, representing a minimum of one individual. The elements consist of four metapodials and one first phalanx.

Angulate tortoise (Chersina angulata)

There are ten bones identified to angulate tortoise, representing a minimum of one individual. Three bones could be identified only to carapace. Otherwise there are three long bones, and seven carapace bones. There are two burnt bones, a carapace and a long bone.

Snake

Four vertebrae were identified only to snake.

Lizard

There is a humerus and a scapula identified to lizard.

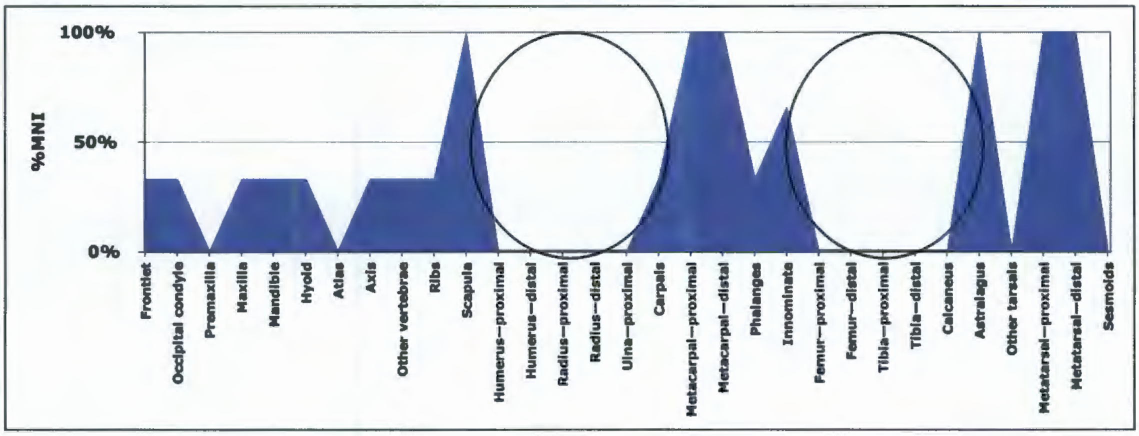
Surface1&2

The second occupation surface 1&2 has 3,259 bones weighing 810g, with 1,142 (35%) identified to species or class size. The most abundant species is the angulate tortoise (*Chersina angulata*) with at least eight individuals, followed by micromammals (mice, rats, etc.) and steenbok (*Raphicerus campestris*) (Table 3). Other animals identified at the site are a bovid size class II, probably springbok (*Antidorcas marsupialis*) or grey duiker (*Sylvicapra grimmia*), Cape hare (*Lepus capensis)*, wild cat (*Felis lybica)*, Bat eared fox (*Otocyon megalotis)*, Cape fur seal (*Arctocephalus pusillus)*, a medium sized carnivore, Brant's whistling rat (*Otomys brantsii)*, Rock elephant shrew (*Elephantulus edwardii)*, a small mammal, a medium mammal, penguin (*Spheniscus demersus)*, a medium and a large aves, lizard, snake, and fish.

Steenbok (Raphicerus campestris) and small mammal

There are 81 bones identified to steenbok, representing at least three individuals based on tali. Most elements are present including the crania and phalanges suggesting that the animals were brought to the site for primary butchery. Based on the fusion of the long bones, there is at least one juvenile in the sample and from the dentitions, there are two different aged adults, a young adult with light wear and a middle adult with moderate wear. One of the adults is male, identified by the presence of a horn core. The distribution of the elements (Fig. 9.13) suggests that while the animals were processed at KN6-3C, the main meat bearing bones are missing: there are no humeri, radii, ulnae, femora or tibiae. This suggests that the high utility elements and best cuts of meat were removed to another location.

Figure 9.13 **The element distribution of steenbok at KN6-3C, surface 1&2. Note that the main meat bearing bones are absent. MNI (100%)=3**



Bovid size class II (springbok and or grey duiker)

There is a total of six elements identified to bovid size class two (BovII), three molars, a premolar, a vertebra, and a calcaneus. The presence of teeth and foot bones suggests that the entire animals were returned to the site for primary butchery. The wear of the molars suggests that there may be three individuals, a young adult with light wear, a middle adult with moderate wear, and an old adult with heavy wear. The lack of any other bones suggests that the carcass was heavily processed and the high utility bones were removed from the site.

Cape hare (Lepus capensis)

There are three bones identified to Cape hare representing at least one individual: a radius, a tibia, and a humerus.

Wild cat (Felis lybica)

There are three bones identified to wild cat representing a minimum of one individual: a calcaneus, an unciform, and a metatarsal. Two of the bones are from the surface 1 while the third bone is from surface 2, providing further evidence that these layers in fact derive from a single occupation.

Bat eared fox (Otocyon megalotis)

There are three bones identified to bat eared fox representing at least one individual: an ulna and two proximal metapodial fragments.

Cape fur seal (Arctocephalus pusillus)

There are fourteen bones identified to Cape fur seal, representing a minimum of one individual: ten postcanines, two incisors, a canine, and a first phalanx. As the canine was not very large, it is most likely from a female. As the elements consist of teeth and a phalanx, this suggests that the seal underwent primary butchery at the site but was removed, leaving the lowest utility elements behind. Most of the postcanines were in the surface 2 layer, while two were in the surface 1 layer.

Medium carnivore

A total of two elements could be identified only to medium carnivore. The elements consist of a distal metapodial and a third phalanx, a claw.

Small mammal

There are 473 bones identified to small mammal, most of which are long bone shaft fragments. The highly fragmented nature of the assemblage suggests that these bones are most likely to be the missing steenbok long bones that were heavily processed for marrow. This is not to say however, that all of the elements in this category are steenbok.

Medium mammal

There are a total of ten bones identified to medium mammal, six long bone shaft fragments, three rib fragments, and a fragment of a proximal ulna.

Brant's whistling rat (Otomys brantsii)

A total of two elements were identified to Brant's whistling rat representing at least one individual: an incisor and a third molar.

Rock elephant shrew (Elephantulus edwardii)

There are five elements identified to rock elephant shrew representing a minimum of three individuals. There are three right mandibles and two left mandibles.

Micromammal sp.

There are 44 elements identified to micromammals, dominated by mandibles and teeth. In order to have a large sample of elements to look at the relative abundance of the bones, all micromammal elements were lumped together, including the Brant's whistling rat and rock elephant shrew (Fig. 9.14). The distribution of the micromammals (Fig. 9.15) is focussed in the northern midden, with a dense concentration of mandibles and molars from many individuals at square M16, the probable place of decapitation prior to consumption. There was no evidence for acid etching and the long bone fragments that are present are heavily fragmented (Table 9.5): only one complete long bone is a tibia. The dominance of skull bones and the relative paucity of long bones and vertebrae suggest that humans were responsible for the presence of the some of the micromammals at KN6-3C (cf. Chapter 6, Dewar & Jerardino 2007).

Table 9.5 Post-cranial breakage of micromammals at KN6-3C, surface 1&2

Elements	No.	%No.
Humerus		
Complete	0	0
Proximal	0	0
Shafts	0	0
Distal	3	100
Femur		
Complete	0	0
Proximal	4	0
Shafts	0	0
Distal	0	0
Tibia		
Complete	1	33.3
Shafts	1	33.3
Proximal	0	0
Distal	1	33.3

Figure 9.14 The relative abundance of micromammals at KN6-3C. MNI (100%)=6

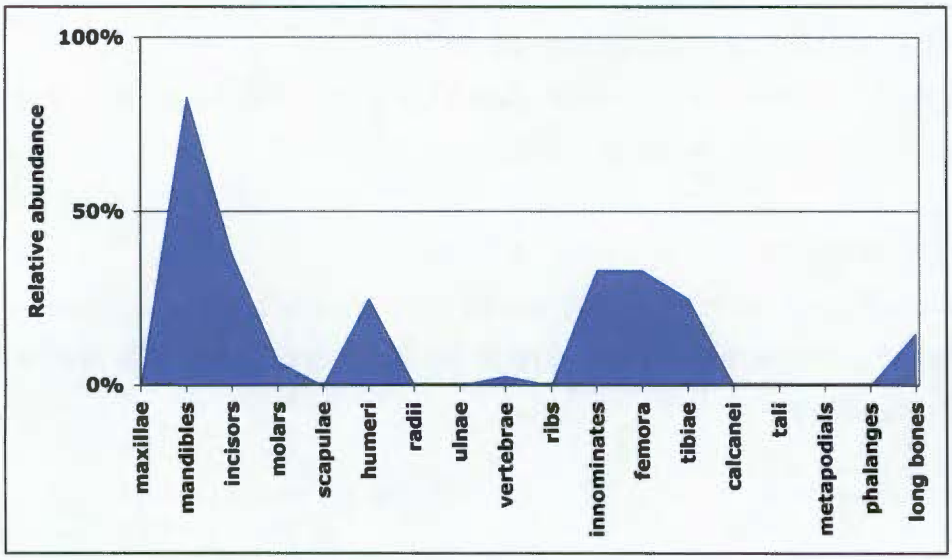
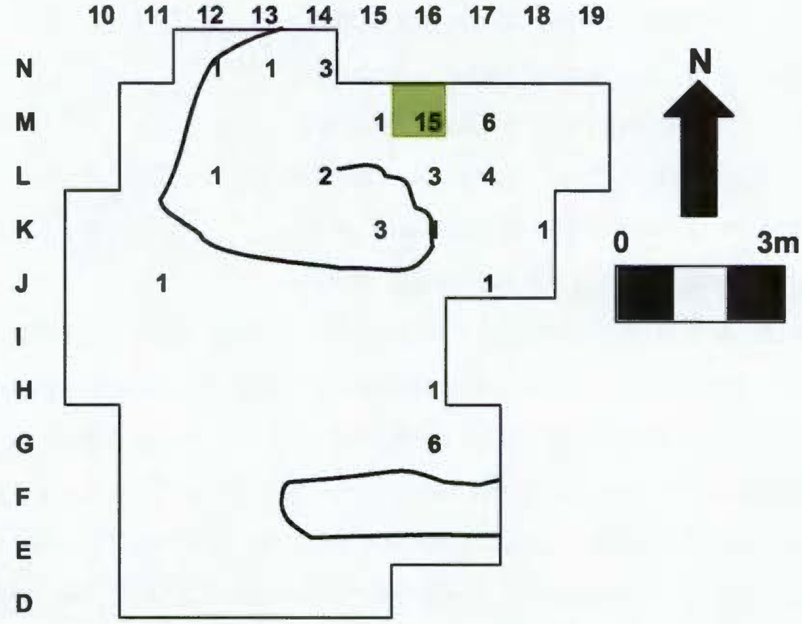


Figure 9.15 The spatial distribution of micromammals from the second occupation 1&2 at KN6-3C. The green square shows the area of high concentration of micromammal elements, dominated by mandibles and molars



African penguin (Spheniscus demersus)

There are four bones identified to penguin representing a minimum of one individual: a left and right tympanic bullae, a mandible, and a humerus.

Medium aves

One ulna was identified to medium aves.

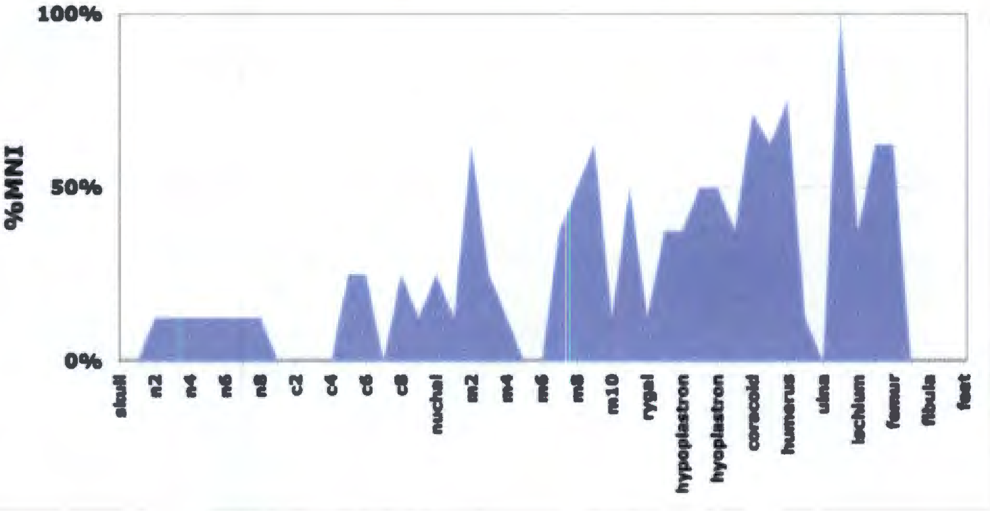
Large aves

One long bone fragment could be identified only to large aves.

Angulate tortoise (Chersina angulata)

A total of 458 elements were identified to angulate tortoise, representing at least eight individuals, based on ilia. A total of 291 elements could be classified only as carapace fragments, one could only be called marginal, and another could only be identified as a neural. The majority of elements are present with the exception of the skulls and phalanges (Fig. 9.16).

Figure 9.16 **The element distribution of angulate tortoise from the second occupation surface 1&2 at KN6-3C. MNI(100%)=8. C=carapace, M=marginal, N=neural**



This could mean that the tortoises were processed elsewhere and only the shells were brought to the site, but tortoises are easy to collect and it is more efficient to cook them whole. A second possible explanation for the missing head and foot bones is that they were consumed and therefore removed from the site by the occupants. A third possibility is that the skulls and feet were damaged beyond recognition during cooking. 92 tortoise bones show evidence for heat alteration: 75 carapace bones, one plastron, and 16 long bones. This suggests that the tortoises were placed on the fire on their backs. The burnt long bones may be refuse, thrown into the fire after consumption of the meat.

The breadth of the distal humeri and femora were measured when possible. Due to the fragmented nature of the femora, none were available from this sample, but there are four measurable humeri with a mean breadth of 6.6±0.7mm with a range from 6.0-7.7mm.

Lizard

There are ten lizard bones representing at least five individuals: eight humeri and two mandibles.

Medium snake

There are 19 medium size snake bones representing at least one individual the size of a berg adder *(Bitis atropus).* All elements are present including skull bones, ribs, and vertebrae.

Small fish

Three bones could be identified only to small fish, a ray, a vertebra, and a cranial bone.

Bone modifications

Modifications made on the bones include evidence for heat alteration, carnivore gnawing, spiral breakage, and weathering (Table 9.6). The first occupation surface 3 has only five burnt bones and two with stage 1 weathering (Behrensmeyer 1978). The second occupation surface1&2 has 143 burnt bones (Table 9.5). Evidence for carnivore activity is present with ten bones having gnaw marks, although this only accounts for 0.3% of the assemblage. While three bones have dry transverse breaks, 275 bones have fresh spiral breaks. Only two bones are weathered from surface1&2, and along with the low frequency of carnivore activity, suggests that the site was rapidly buried after abandonment. The lack of cut marks is interesting, but due to the heavy fragmentation of the long bones, the cut marks may simply have been obscured.

Table 9.6 **Modifications identified on the bone at KN6-3C**

	Modification	**Burnt**	**Carnivore gnawing**	**Spiral break**	**Transverse break**	**Weathered**
Surface1&2 (N=3,259)	No.	143	10	275	3	2
	%No.	4.4	0.3	8.4	0.09	0.06
Surface 3 (N=80)	No.	5				2
	%No.	6.3				2.5

Crayfish (Jasus lalandii)

The first occupation surface 3 has 21 mandibles with a MNI of 11 based on right mandibles. The mean right mandible length is 15.9±4.2mm with a range of 10.7-19.8mm. The mean left mandible length is 11.9±3.9mm with a range of 8.2-17.6mm. Following Jerardino *et al.* (2001), the derived average length of the carapace is 104.1± 25.3mm with a range of 72.7-127.4mm based on right mandibles and 85.2± 24.5mm with a range of 61.4-120.5mm based on left mandibles. The reason for the discrepancy between sides is unclear, but the right mandibles are particularly large.

The second occupation surface1&2 has 1,534 crayfish mandibles with an MNI of 773 based on right mandibles. The mean length of the right mandibles is 14.4±3.5 mm with a range of 6.3-24.4mm. The mean length of the left mandibles is 13.2±3.3mm with a range of 6.2-22.8mm. Following Jerardino *et al.* (2001), the mean carapace length is 95.1± 21.0mm with a range of 46.3-155.2mm based on right mandibles and 92.7±20.8mm with a range of 48.8-153.2mm based on left mandibles.

Shellfish

All shellfish was collected and brought back to the University of Cape Town, but due to the enormous size of the assemblage, a sub sample of five m^2 was used to analyse the species composition and conduct measurements. In the first occupation surface 3, the dominant shellfish species are *Cymbula granatina* (54.5%), *S. argenvillei* (18.2%) *and Burnupena sp* (15.9%). Other shellfish species present in this occupation include *S. granularis* and *Choromytilus meridionalis* (Table 9.7). The mean length of the measurable shells is: *C. granatina* 52.7±8.5mm, *S. argenvillei* 68.9±20.5mm, *C. meridionalis* 82.9±12.9mm. There is also one measurable *S. granularis* at 35.3mm (Table 9.8).

Table 9.7 **The shellfish species identified at KN6-3C**

Species	Surface1&2		Surface3	
	MNI	%assemblage	MNI	%assemblage
Scutellastra granularis	547	41.3	3	6.8
Cymbula granatina	346	26.1	24	54.5
Scutellastra argenvillei	143	10.8	8	18.2
Burnupena sp.	116	8.7	7	15.9
Choromytilus meridionalis	97	7.3	2	4.5
Unidentifiable	65	4.9		
Scutellastra barbara	7	0.5		
Scutellastra miniata	3	0.2		
Crepidula fornicata	1	0.07		
Aulacomya ater	1	0.07		
Total	**1326**		**44**	

Table 9.8 **The mean length and relevant statistics for the dominant species of shellfish at KN6-3C**

Occupation	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
Surface1&2					
S. granularis	338	36.7	5.6	21.5	59.2
C. granatina	139	60.2	9.0	41	80.5
S. argenvillei	103	68.4	14.9	26.6	90.6
C. meridionalis	83	77.0	9.6	55	111
Surface 3					
C. granatina	17	52.7	8.5	39	69.3
S. granularis	1	35.3			
S. argenvillei	6	68.9	20.5	29.6	85.3
C. meridionalis	2	82.9	12.9	73.8	92.1

The second occupation surface 1&2 is dominated by *S. granularis* (41.3%), followed by *C. granatina* (26.1%) and *S. argenvillei* (10.8%). There is a wider range of species present in the second occupation with the addition of *S. barbara, S. miniata, Crepidula fornicata,* and *Aulacomya ater* as well as *Burnupena sp.* and *C. meridionalis* (Table 9.7). Due to the fragmentation of the shell, there is also a category of unidentifiable apices. The mean length of the measurable shells is: *S. granularis* 36.7±5.6mm, *C. granatina* 60.2±9.0mm, and *S. argenvillei* 68.4±14.9mm. There is also one measurable

S. granularis at 35.3mm (Table 9.8).

Clearly there is a noticeable difference in the percentage of *S. granularis* and *C. granatina* between the two occupations.

Kilojoules

The kilojoules from the first occupation surface 3 is dominated by terrestrial species at 75% of the assemblage (Fig. 9.17). Steenbok dominate the diet, providing 67% of the kilojoules, followed by crayfish at 11%, and *C. granatina* at 7% (Fig. 9.18 & Table 9.9). The shellfish contribute a relatively small proportion of the total available kilojoules at 14%.

The second occupation, surface 1&2, is dominated by marine species at 63% of the total available kilojoules (Fig. 9.17). *C. granatina* and crayfish dominate the assemblage at 20% each, followed by BovII at 19% of the diet (Fig. 9.18). Carnivores including Cape fur seal contribute 12% of the diet. The total kilojoules provided by shellfish is high at 58%.

The distribution of kilojoules at the two occupations are very different, the earliest occupation is dominated by terrestrial species while the second occupation is far more focussed on marine resources.

Figure 9.17 **The ratio of terrestrial and marine kilojoules at KN6-3C. The left chart is for surface 1&2, while the right chart is for surface 3**

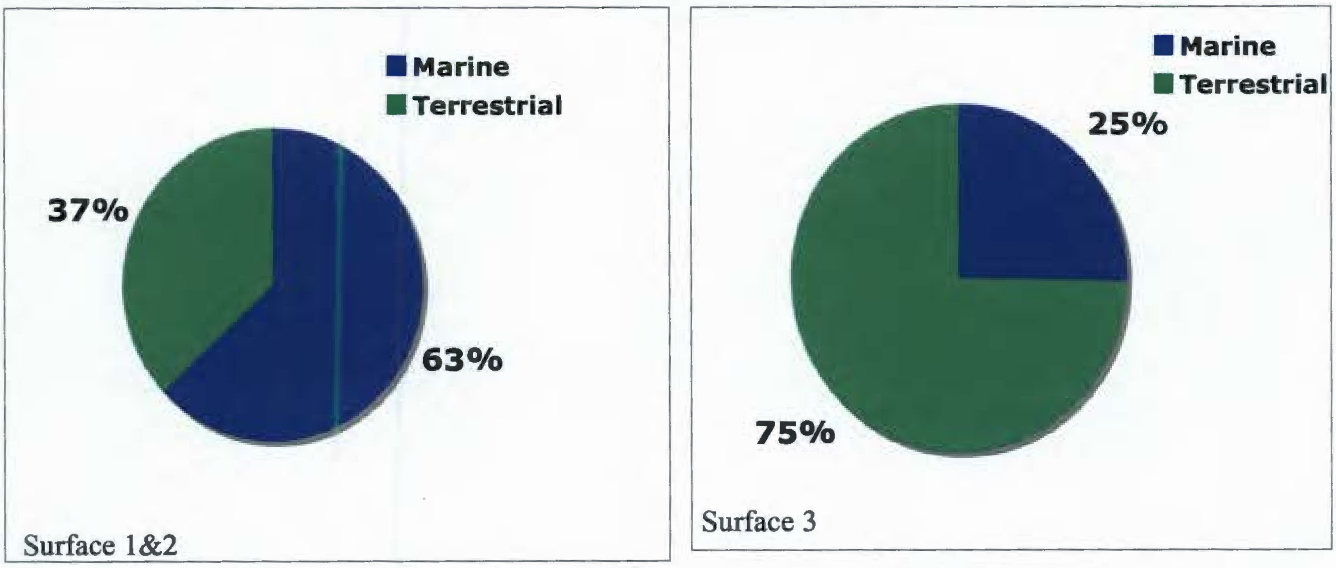
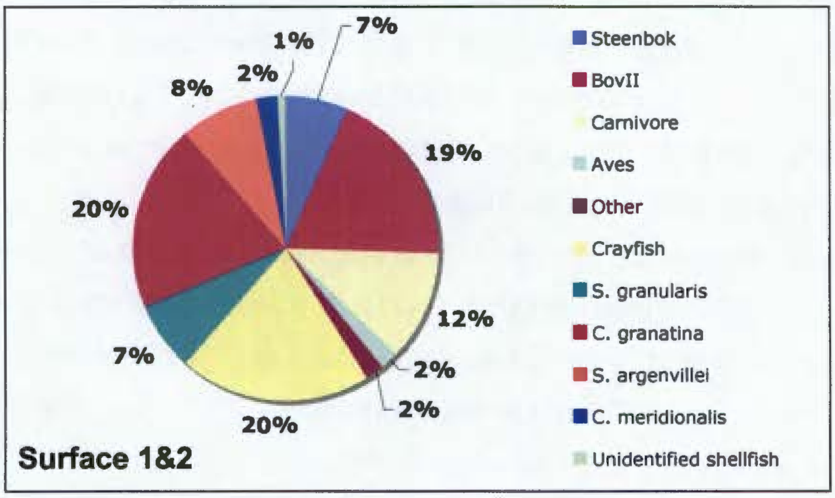


Figure 9.18 **The distribution of kilojoules at KN6-3C by species. The top chart represents the kilojoules for surface 1&2, while the bottom chart is surface 3**



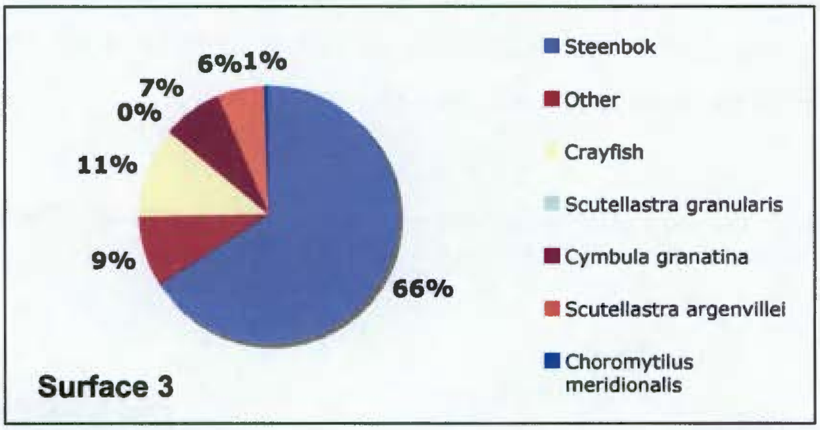


Table 9.9 The distribution of kilojoules at KN6-3C

TAXON	Surface 1&2			Surface 3		
	KJ/animal	Number of animals	Total KJ	KJ/animal	Number of animals	Total KJ
Crayfish	560.6	773	433,343.8	726.3	11	7,989.3
Steenbok	47,000	3	141,000	47,000	1	47,000
Bovid size class II	134,150	3	402,450			
Cape hare	9,800	1	9,800			
Wild cat	22,040	1	22,040			
Bat eared fox	22,040	1	22,040			
Cape fur seal	165,000	1	165,000			
Medium carnivore	36,540	1	36,540			
Brant's whistling rat	1,400	1	1,400	1,400	1	1,400
Rock elephant shrew	100	3	300	100		
Micromammals	1,000	4	4,000	1,000	1	1,000
African penguin	11,160	2	22,320			
Medium aves	9,450	1	9,450			
Large aves	9,450	1	9,450			
Angulate tortoise	2,000	8	16,000	2,000	1	2,000
Lizard	1,000	5	5,000	1,000	1	1,000
Medium snake	1,000	1	1,000	1,000	1	1,000
Fish	1,000	1	1,000			
Scutellastra granularis	14.5	10,666.5	154,664.25	14.5	24	192
Cymbula granatina	62.8	6,747	423,711.6	62.8	192	5,280
Scutellastra argenvillei	63.6	2,788.5	177,348.6	63.6	64	4,070.4
Choromytilus meridionalis	23.9	1,891.5	45,206.85	23.9	16	467.2
Unidentifiable	14.5	1,267	18,371.5			

Discussion and conclusion

KN6-3C consists of two in situ shell middens within a deflation zone. The site is 150m east of the shoreline and a prominent rocky headland that today is teeming with shellfish. The Swartlinjies River lays 5km to the south but it is usually a dry riverbed, flowing only after abnormally heavy rains in the Kamiesberg mountains 100km inland.

Surface 3

The first occupation of KN6-3C occurred at roughly 2684BC. The lithic assemblage is small and is nearly equally distributed between quartz crystal and CCS. Formal tools are predominantly made on CCS and include a range of scraper forms and a borer/drill, while there is a single backed artefact on quartz crystal. There are no hammerstones or grindstones, but the large number of waste material, formal tools, and cores suggest that tools may have been manufactured on site. There is also one piece of red ochre. There is very little ostrich eggshell, but one fragment is decorated. The subsistence strategy is focused on a narrow range of small-bodied terrestrial animals with steenbok providing the largest percentage of kilojoules. There are only five identified vertebrate species and six invertebrate species.

Surface 1&2

The second occupation surface 1&2 occurred at roughly 1500BC. The stone assemblage is clearly dominated by quartz crystal but the formal tools are predominantly made on CCS. The formal tools that are made on either quartz or CCS consist primarily of backed forms. A point of interest is the high number of borers/drills as they are rare in this region. There are many hammerstones, cores, debitage and formal tools, suggesting that lithics were being processed on site. In addition, the presence of grindstones, and in particular one covered in ochre, identifies that grinding activities occurred at this site: a core is also covered in ochre. The ostrich eggshell sample consists of two decorated pieces and two pieces with bevelled edges. The ostrich eggshell beads are relatively small, and consist of both complete and unfinished beads, suggesting that bead manufacturing occurred at the site. The only other artefacts at the site are two broken bone beads of the same diameter. The subsistence strategy is focussed on a marine diet with *C. granatina* dominating the kilojoules. There is a wide diet breadth with a total of 16 vertebrate species and ten invertebrate species. While it is possible that the carnivores, with the exception of the Cape fur seal, were actually being collected for their pelts, their presence is of interest and adds a further dimension to the site.

Other than the difference in subsistence strategies the assemblages from the two occupations are fairly similar and the differences may be attributed to the biasing affect of sample size. The first occupation is a tenth of the size of the second occupation, which is probably related to length of stay or population size. This would mean having to broaden your diet to accommodate more people or more days in the same place.

Chapter Ten: LK5-1

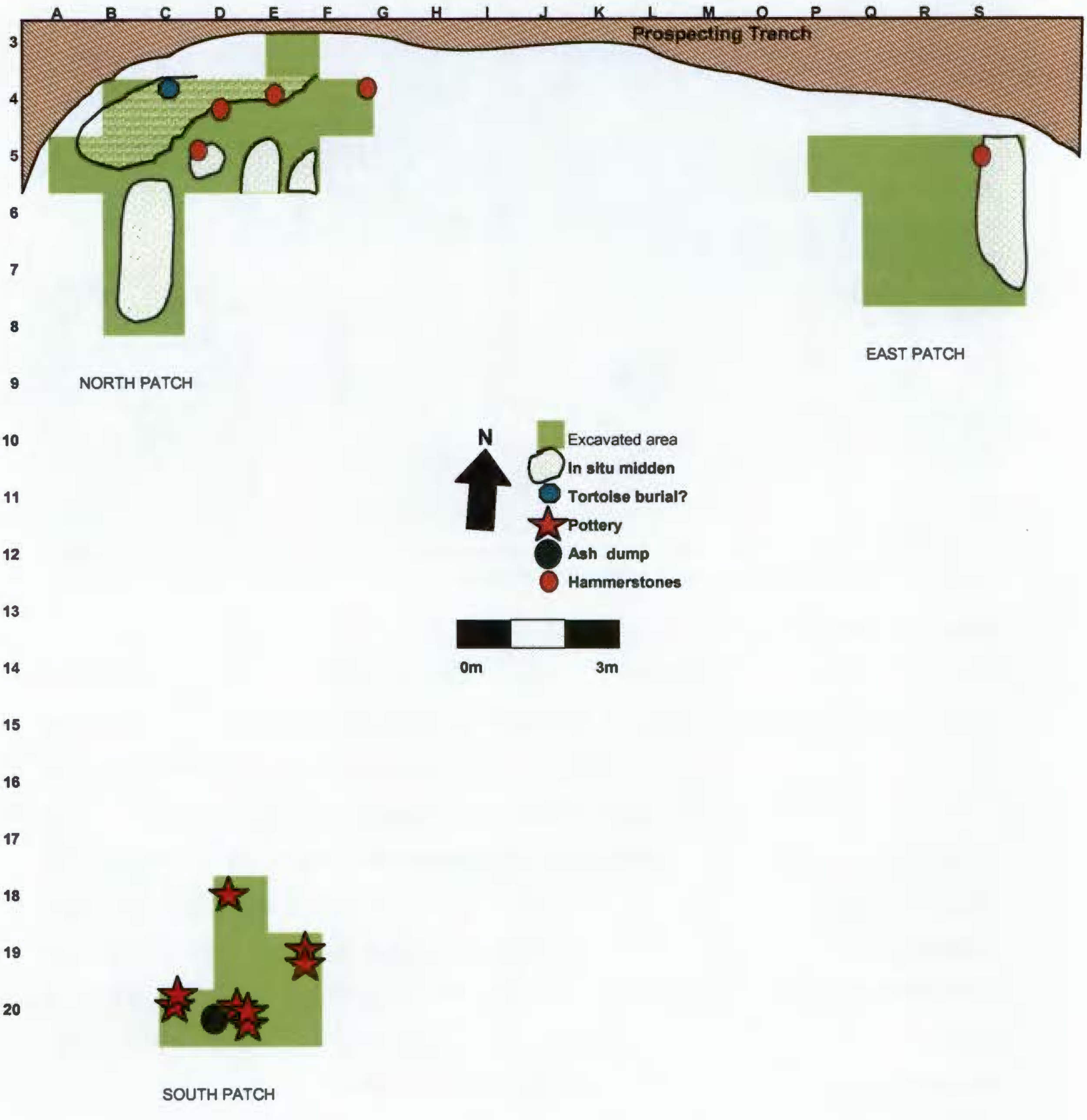
Figure 10.1 **Facing west from the road, looking onto LK5-1 during excavation, showing where the prospecting trench cuts through the site**

Introduction

LK5-1 (LK2001-013) is located on top of a coastal fore dune or sand transport corridor, 72m due east of the Atlantic Ocean, Namaqualand, South Africa (30°22' 39.5" S 17°18' 30.4" E) (Fig. 1.5). The surface shell scatter is roughly 20m in diameter and consists of three discrete shell patches (Fig. 10.2). The shoreline is a bay with a sandy beach, a palaeoriver mouth with a large rocky headland to the south (Fig. 1.5). The north end of the site is truncated by an old prospecting trench (Fig. 10.1) that follows the palaeoriver channel. Today, the prospecting trench is filled with fresh water, suggesting that it lies within a streambed. Otherwise, the nearest rivers and therefore known fresh water sources are the Swartlinjies 13.2km to the north and the Spoeg River 11.5km to the south.

LK5-1 was identified in 2001 by the Archaeology Contracts Office during an intensive archaeological survey of the region for the DeBeers Namaqualand Mine. The site was first observed as a shell lens in the side of the prospecting trench and would not have been identified otherwise. Due to the potential for

Figure 10.2 Plan of LK5-1

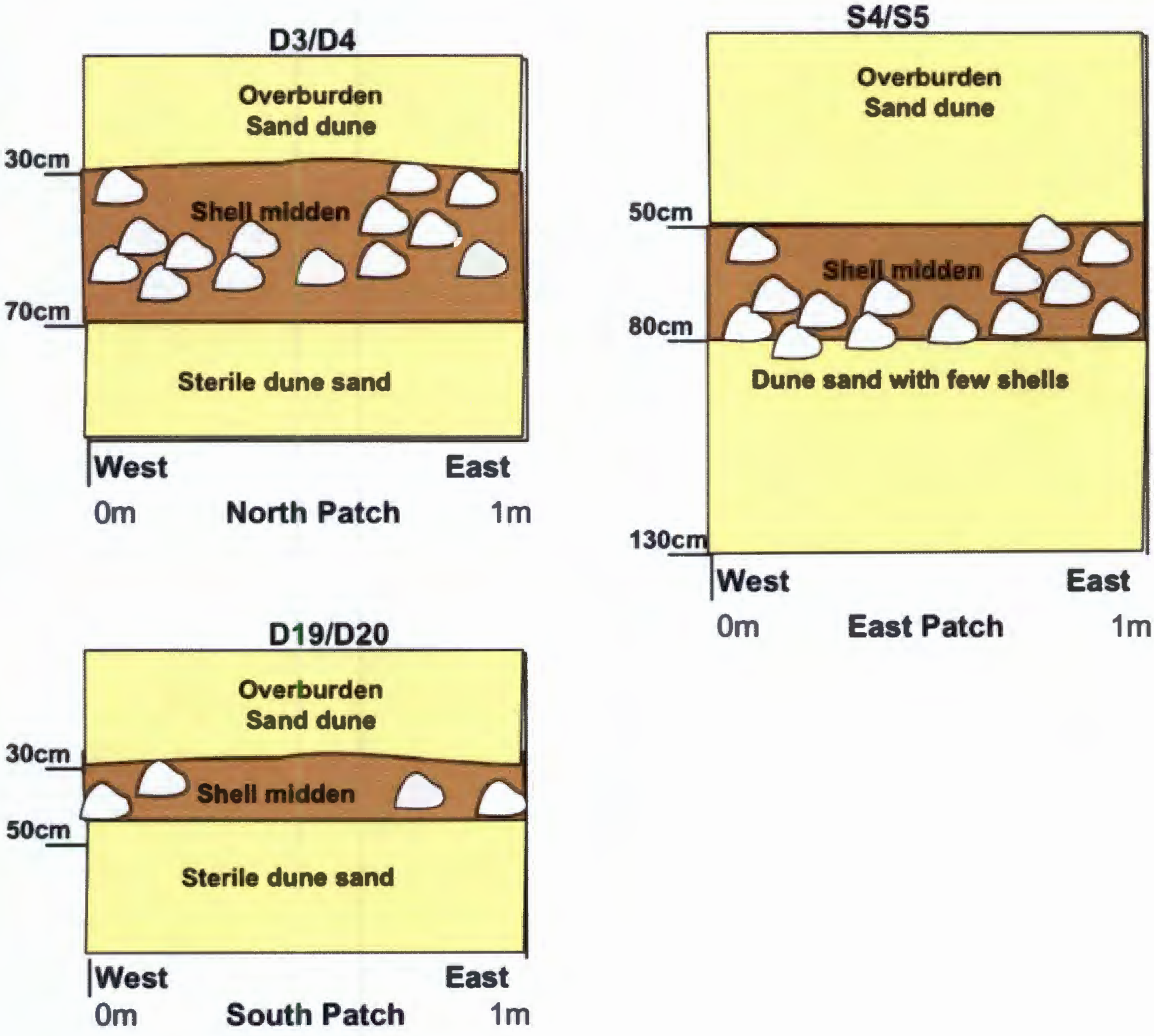


further loss of material, the site was excavated in 2002 and again in 2005. Unfortunately, upon returning to the site in 2005, we were only able to extend the north patch by 8.75 m^2, as a road now cuts through the east and south patches. However, this report covers the material obtained from both excavation seasons.

Excavation

There was a substantial overburden of dune sand covering the site (Fig. 10.3), which had to be removed with spades before the in situ material could be isolated. When shellfish began to appear at the surface, the site was excavated in $1m^2$ units using standard excavation methods: trowels, pans, buckets, a 3mm sieve, and a 1.5mm sieve. A total of $30.75m^2$ were excavated over three patches: $14.75m^2$ at the north patch, $10m^2$ at the east patch, and $6m^2$ at the south patch (Fig. 10.2).

Figure 10.3 **Schematic profile of the three patches from LK5-1**



Stratigraphy

Unfortunately the volume was not recorded during the first season, but 0.25m^3 were removed from the 8.75m^2 that were excavated from the north patch in 2005. The north patch was covered in 30cm of overburden and the shell midden was 40cm thick (Fig. 10.3). The east patch was covered with 50cm of overburden and the subsequent shell midden was 30cm thick (Fig. 10.3). The south patch had an overburden of 30cm and the shell layer was only 15cm thick (Fig. 10.3). Shellfish and a few lithic artefacts continued down into the sand another few cm, but as this occurred in only one square it is most likely due to bioturbation. All squares were excavated down to sterile dune sand and the material was collected and returned to the University of Cape Town for analysis. All three patches exhibit a single occupation layer.

Features

There is a single black patch or ash dump at LK5-1 located in the south patch area (Fig. 10.2). The ash dump has stained the sand surrounding it and consists of charcoal flecks and burnt shell. The dump is approximately circular with a diameter of 25cm.

Radiocarbon dates

Two samples of marine shellfish were sent for radiocarbon dating, one from the north patch and another from the east patch. The north patch sample returned a radiocarbon date of 2180±50 BP (Pta-9326) and a calibrated radiocarbon date of 383AD (320-429AD). The shell from the east patch returned a radiocarbon date of 2870±60 BP (Pta-9312) with a calibrated radiocarbon date of 411BC (525-378 BC). These two patches are clearly separate occupation events and are thus separate sites. The south patch was not initially radiocarbon dated because it has pottery in the assemblage, an artefact type that did not appear in South Africa until approximately 2000BP. The south patch is therefore younger than the other patches, representing a third occupation event. Therefore, there are three separate occupation areas each with a single occupation layer.

Spatial distribution of archaeological material

The archaeological remains present at all three patches include lithics, ostrich eggshell, bone, crayfish, and shellfish. The south patch also has pottery and ostrich eggshell beads.

Lithics are scattered across all three patches, but the east patch has the highest concentration (Fig. 10.4). There is relatively little ostrich eggshell at any of the patches. Ostrich eggshell is associated with the in situ midden in the north patch and the ash dump in the south patch (Fig. 10.5). Ostrich eggshell beads and pottery are confined to the south patch (Figs. 10.2 & 10.5). Bone occurs in all three patches with the north patch having the highest concentration (Fig. 10.6). Crayfish mandibles are scattered across all three patches with a void in the southwest corner of the east patch. The highest concentration of crayfish mandibles is within the north patch (Fig. 10.7). As the volume of the shellfish sample is high a sub-sample was collected for analysis. Unfortunately, the sampling procedures prevent the mapping of shellfish at the site.

Figure 10.4 **The spatial distribution of lithics at LK5-1. The values are numbers of lithics per square. Blue highlights the areas of dense concentration with values greater than 14 lithics per square**

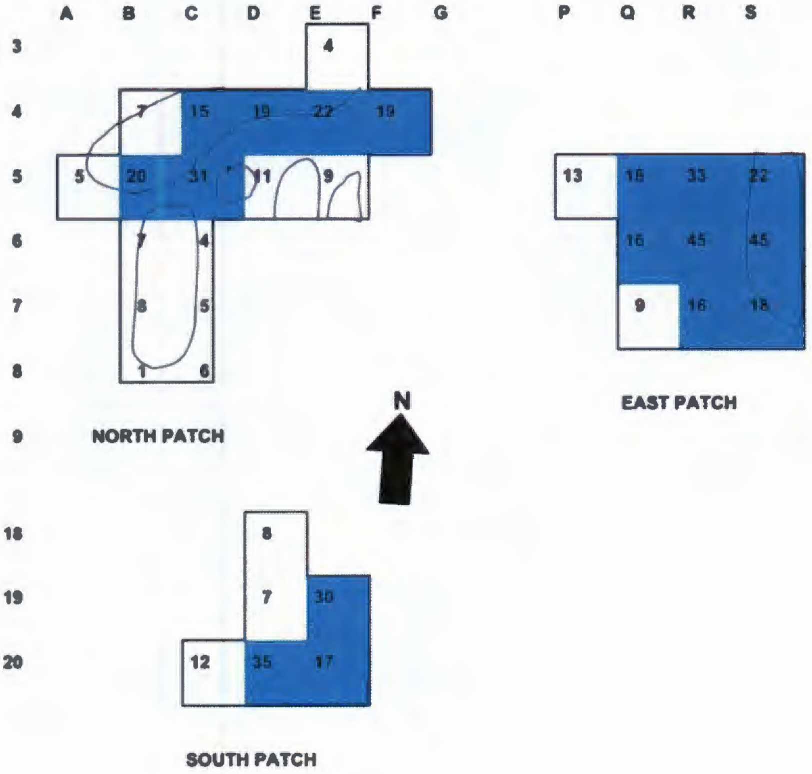


Figure 10.5 The spatial distribution of ostrich eggshell at LK5-1. The values are numbers of eggshell fragments per square. Orange highlights the areas of dense concentration with values greater than three fragments per square. The inset map shows the distribution of the ostrich eggshell beads in the south patch

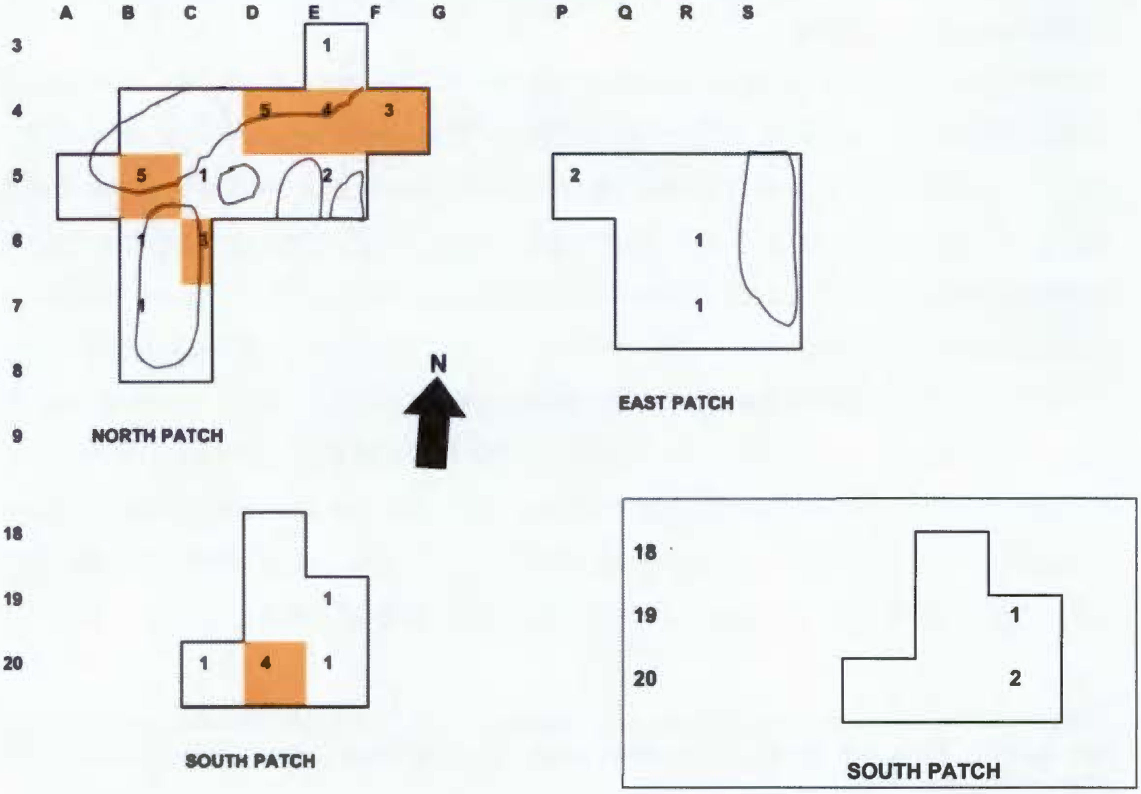


Figure 10.6 The spatial distribution of bone at LK5-1. The values are number of bones per square. Green highlights the areas of dense concentration with values greater than 50 bones per square

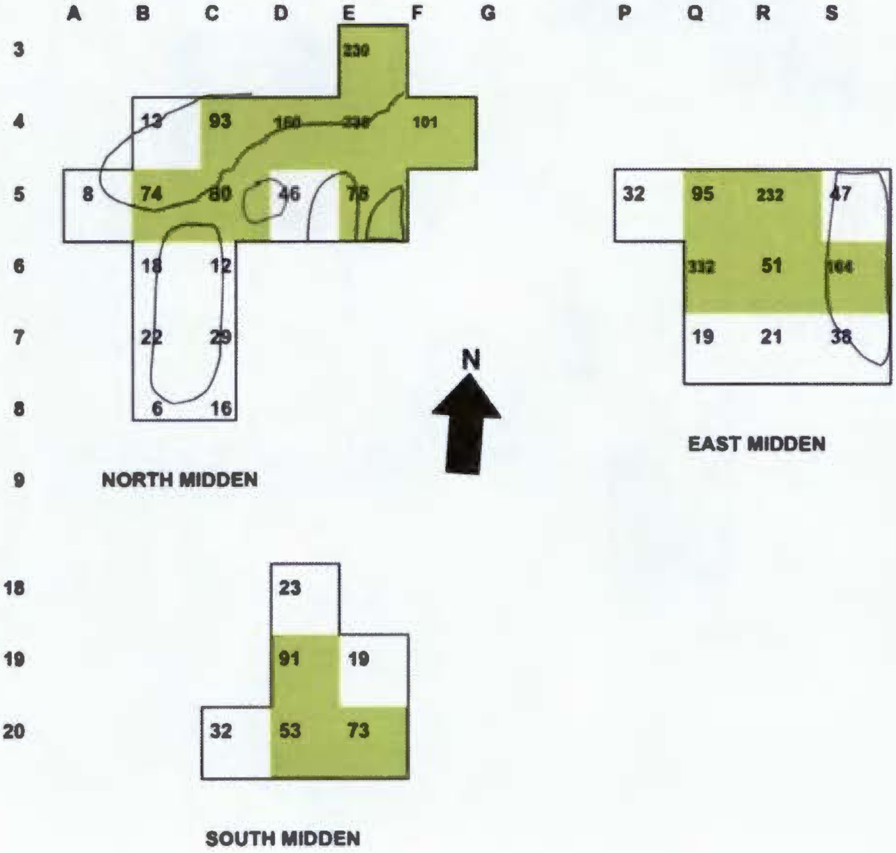
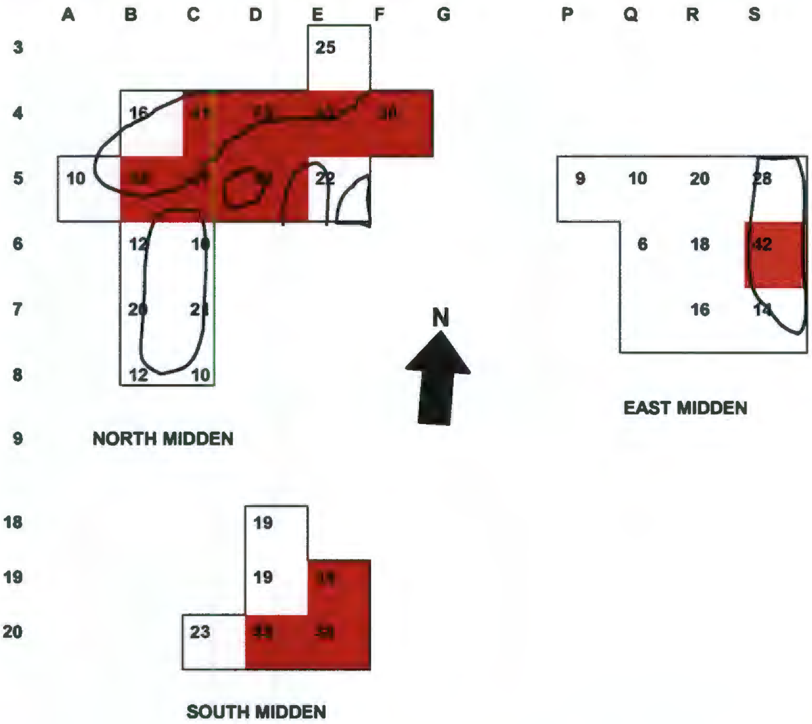


Figure 10.7 The spatial distribution of crayfish at LK5-1. The values are numbers of mandibles per square. Red highlights the areas of dense concentration with values greater than 30 mandibles per square



Lithics

Table 10.1 Lithic raw materials at LK5-1

Stone	North patch		East patch		South patch	
	No.	%No.	No.	%No.	No.	%No.
Quartz crystal	153	79.3	146	62.1	78	71.6
Quartzite granular	20	10.4	66	28.1	9	8.3
Other	12	6.2	10	4.3	1	0.9
CCS	5	2.6	4	1.7	17	15.6
Quartzite white	2	1.0	2	0.9	3	2.8
Black silcrete	0	0	5	2.1	0	0
Orange silcrete	0	0	2	0.9	0	0
Ochre	1	0.5	0	0	1	0.9
Total	**193**	**100**	**235**	**100**	**109**	**100**

The lithic assemblages from all three areas were identified by Jayson Orton. The north patch yielded 193 lithics, and is dominated by quartz crystal (79.3%) followed by granular quartzite, and is an igneous rock (Table 10.1). Other raw materials include white quartzite, cryptocrystalline silicate (CCS), and a red ochre nodule. These raw materials are for the most part local. However, the source of the quartz crystal, ochre, and CCS remain unclear. The assemblage contains four formal tools (1.0%), a sidescraper and a fragment of a backed bladelet on quartz crystal, and two backed scrapers on CCS (Table 10.2).

Table 10.2 The fine-grained material lithic assemblage at LK5-1

Stone	North patch		East patch		South patch	
	No.	%No.	No.	%No.	No.	%No.
Quartz crystal						
Sidescraper	1	0.5	1	0.4	0	0
Backed scraper	0	0	1	0.4	0	0
Backed bladelet fragment	1	0.5	0	0	0	0
Formals sub-total	**2**	**1.0**	**2**	**0.9**	**0**	**0**
Bladelet	2	1.0	1	0.4	2	1.8
Flake	49	25.4	43	18.3	22	20.2
Chunk	17	8.6	15	6.4	6	5.5
Chip	77	38.9	81	34.5	46	42.2
Debitage sub total	**145**	**73.2**	**140**	**59.6**	**76**	**69.7**
Bipolar core	4	2.0	2	0.9	2	1.8
Single platform core	1	0.5	0	0	0	0
Irregular core	1	0.5	2	0.9	0	0
Cores sub total	**6**	**3.0**	**4**	**1.7**	**2**	**1.8**
Quartzite granular						
Flake	13	6.6	34	14.5	5	4.6
Chunk	3	1.5	11	4.7	3	2.8
Chip	4	2.0	19	8.1	1	0.9
Debitage sub total	**20**	**10.1**	**64**	**27.2**	**9**	**8.3**
Bipolar core	0	0	1	0.4	0	0
Single platform core	0	0	1	0.4	0	0
Cores sub-total	**0**	**0**	**2**	**0.9**	**0**	**0**
Quartzite white						
Flake	1	0.5	2	0.9	2	1.8
Chunk	1	0.5	0	0	0	0
Debitage sub total	**2**	**1.0**	**2**	**0.9**	**2**	**1.8**
Irregular core	0	0	0	0	1	0.9
Cores sub total	**0**	**0**	**0**	**0**	**1**	**0.9**
CCS						
Backed scraper	2	1.0	0	0	1	0.9
Thumbnail scraper	0	0	1	0.4	0	0
Segment	0	0	1	0.4	0	0
Formals sub total	**2**	**1.0**	**2**	**0.9**	**1**	**0.9**
Flake	3	1.5	1	0.4	4	3.7
Chunk	0	0	0	0	5	4.6
Chip	0	0	1	0.4	6	5.5
Debitage sub total	**3**	**1.5**	**2**	**0.9**	**15**	**13.8**
Single platform core	0	0	0	0	1	0.9
Cores sub total	**0**	**0**	**0**	**0**	**1**	**0.9**
Silcrete black						
Flake	0	0	4	1.7	0	0
Chip	0	0	1	0.4	0	0
Debitage sub total	**0**	**0**	**5**	**2.1**	**0**	**0**
Silcrete orange						
Flake	0	0	2	0.9	0	0
Debitage sub total	**0**	**0**	**2**	**0.9**	**0**	**0**

Debitage from all raw materials consists of flakes, chunks, chips, and bladelets accounting for 88.7% of the assemblage. Cores include bipolar, single platform, and irregular forms, and are all on quartz crystal (Table 10.2). The remaining and irregular forms, and are all on quartz crystal (Table 10.2). The remaining lithics are made on coarse-grained igneous rock and consist of a hammerstone, hammerstone/upper grindstone, an upper grindstone, a fragment of an upper grindstone, a lower grindstone, and a fragment of a lower grindstone (Table 10.3). The presence of debitage, cores, and many hammerstones suggests that lithic processing activities occurred at this patch while the grindstones suggest grinding activities, however, there is no indication of what was being ground. The ochre does not have ground facets.

Table 10.3 **The coarse-grained lithic material assemblage at LK5-1**

Stone	North patch		East patch		South patch	
	No.	%No.	No.	%No.	No.	%No.
Other igneous rock						
Flake	2	1.0	4	1.7	0	0
Chunk	1	0.5	1	0.4	0	0
Debitage sub total	**3**	**1.5**	**5**	**2.1**	**0**	**0**
Hammerstone	0	0	1	0.4	0	0
Hammerstone/upper grindstone	4	2.0	0	0	0	0
Upper grindstone	1	0.5	1	0.4	0	0
Upper grindstone fragment	1	0.5	0	0	0	0
Lower grindstone	1	0.5	0	0	0	0
Lower grindstone fragment	1	0.5	0	0	0	0
Hammerstones/ grindstones sub total	**8**	**4.0**	**2**	**0.9**	**0**	**0**
Manuport	**1**	**0.5**	**3**	**1.3**	**1**	**0.9**
Ochre						
Nodules	1	**0.5**	0	**0**	1	**0.9**

The east patch contained 235 stone artefacts and is dominated by quartz crystal (62.1%) followed by granular quartzite and the igneous rock (Table 10.1). Other raw materials present in this patch include white quartzite, CCS, black silcrete, and an orange silcrete. There are four formal tools (1.7%) a sidescraper and a backed scraper on quartz crystal and a segment and thumbnail scraper on CCS (Table 10.2). Debitage consists of flakes, chunks, chips, and bladelets accounting for 93.6% of the stone assemblage. Cores consist of bipolar, single platform, and irregular forms on quartz crystal and granular quartzite (Table 10.2). The remaining lithic artefacts consist of a hammerstone, an upper grindstone, and three manuports on the igneous rock (Table 10.3). Again, the presence of debitage, cores, and a hammerstone suggests that lithic processing activities occurred in this patch. The presence of an upper grindstone is suggestive of grinding activities but the site lacks the bottom half of the grinding apparatus.

The south patch yielded 109 lithic artefacts dominated by quartz crystal (71.6%) followed by CCS and granular quartzite (Table 10.1). Other raw materials include white quartzite, an igneous rock, and a red ochre nodule. There is one formal tool, a backed scraper made on CCS (Table 10.2). Debitage consists of flakes, chunks, and chips accounting for 95.4% of the assemblage. There are two bipolar cores of quartz crystal. There are no hammerstones or grindstones, but there is an igneous rock manuport and an ochre nodule (Table 10.3). The presence of debitage suggests that lithic processing activities occurred at this patch, but the hammerstone must have been removed or was not found during excavation.

Pottery

There are a total of eight pottery sherds weighing 130.7g with no decoration. All sherds were found in the south patch and four of them are rims with rounded lips. The matrix is fine-grained with a quartz temper suggesting that the sherds are from the same pot. The average thickness is 7.8±2.6mm with a range from 4.4-14.5mm. The external surface of the potsherds is red/brown while the internal surface is black. One body sherd is quite thick at 14.5mm and seems to be missing a feature such as a lug or boss. Three sherds refitted together, two from square C20 and one from D20, which enabled the determination of the diameter of the pot at 19cm.

Ostrich eggshell

Fragments

There are a total of 21 ostrich eggshell fragments weighing 43.5g. The north patch has a total of 27 fragments weighing 31.6g. There is one flask mouth fragment identified by the ground edge and oblique angle of breakage on the interior of the aperture.

The east patch has four fragments of ostrich eggshell weighing 1.6g.

The south patch has seven ostrich eggshell fragments weighing 10.7g. One fragment is burnt, and two are weathered by the wind.

This is a very low frequency of ostrich eggshell as most sites in the region have many ostrich eggshell fragments (personal observation). Perhaps the scarcity of ostrich eggshell suggests that it was brought to the site as fragments in order to make beads or for some other activity, rather than arriving at the various patches as whole eggs.

Beads

There are a total of three ostrich eggshell beads, all in the south patch. The external diameter of bead 1 is 4.9mm with an aperture of 1.8mm; bead 2 is 6.3mm with an aperture of 2.3mm; and bead 3 is 4.5mm with an aperture of 1.5mm. Beads two and three are no longer perfectly round while the aperture of bead one has been wom to the edge of the bead.

Bone

Subsistence strategy

North patch

The north patch has 1,224 bones weighing 415.7g, with 689 (53.8%) identified to species or size class. The most abundant species is angulate tortoise (*Chersina angulata*) with at least 13 individuals, followed by wild cat (*Felis lybica*) and micromammal sp. with a minimum of two individuals each (Table 10.4). Other species identified at this patch include steenbok (*Raphicerus campestris*), bovid size class II (BovII-either springbok *Antidorcas marsupialis*, or grey duiker *Sylvicapra grimmia*), Cape fur seal (*Arctocephalus pusillis*), a small carnivore, small mammal, small-medium mammal, African penguin (*Spheniscus demersus*), fish, frog, and a medium snake.

Steenbok (Raphicerus campestris)

There are fourteen bones identified to steenbok, representing at least one individual. A range of elements is present including skull and foot bones, suggesting the animal underwent primary butchery at this patch. The lack of epiphyseal fusion of the long bones indicates that this individual is juvenile.

Table 10.4 The identified vertebrate species at LK5-1

Taxon		North patch		East patch		South patch	
		NISP	MNI	NISP	MNI	NISP	MNI
Steenbok	*Raphicerus campestris*	14	1	20	2m	5	1
Bovid size class II		4	1	8	1	0	0
Cape hare	*Lepus capensis*	0	0	2	1	0	0
Wild cat	*Felis lybica*	5	2	1	1	0	0
Cape fur seal	*Arctocephalus pusillus*	1	1	1	1	1	1
Small carnivore		1	1	0	0	0	0
Micromammal		11	2	8	1	10	2
Small mammal		62	/	120	/	9	/
Small-medium mammal		1	1	2	1	0	0
Medium mammal		0	0	3	1	0	0
African penguin	*Spheniscus demersus*	4	1	0	0	1	1
Angulate tortoise	*Chersina angulata*	581	13	601	13	63	1
Fish		3	1	0	0	0	0
Frog		0	0	2	1	2	1
Medium snake		2	1	0	0	1	1
Total		**689**	**24**	**768**	**23**	**92**	**8**

*Bovid size class II (*springbok *Antidorcas marsupialis or* grey duiker *Sylvicapra grimmia)*

There are a total of four ribs identified to BovII representing a minimum of one individual. The lack of many other bones suggests that the animal was killed and butchered elsewhere, with the ribs brought to the site.

Wild cat (Felis lybica)

There are five skull bones identified to wild cat, representing at least two individuals based on two right mandibles. The other elements are a maxilla, a molar, and a canine.

Small carnivore

One bone could be identified only to small carnivore, a metatarsal that most likely belongs to one of the wild cats.

Cape fur seal (Arctocephalus pusillus)

An adult post-canine identified a single Cape fur seal.

Micromammal sp.

There are eleven elements identified to micromammal representing a minimum of two individuals. The bones consist of skull fragments, long bones, and vertebrae.

Small mammal

There are 62 elements that could be identified only to small mammal due to the high fragmentation of the sample. The elements consist of long bone shaft fragments, some vertebral and rib fragments. These bones are most likely the missing bones from the wild cats and or the steenbok.

Small-medium mammal

A single tooth is heavily fragmented and can only be identified to a small-medium size mammal.

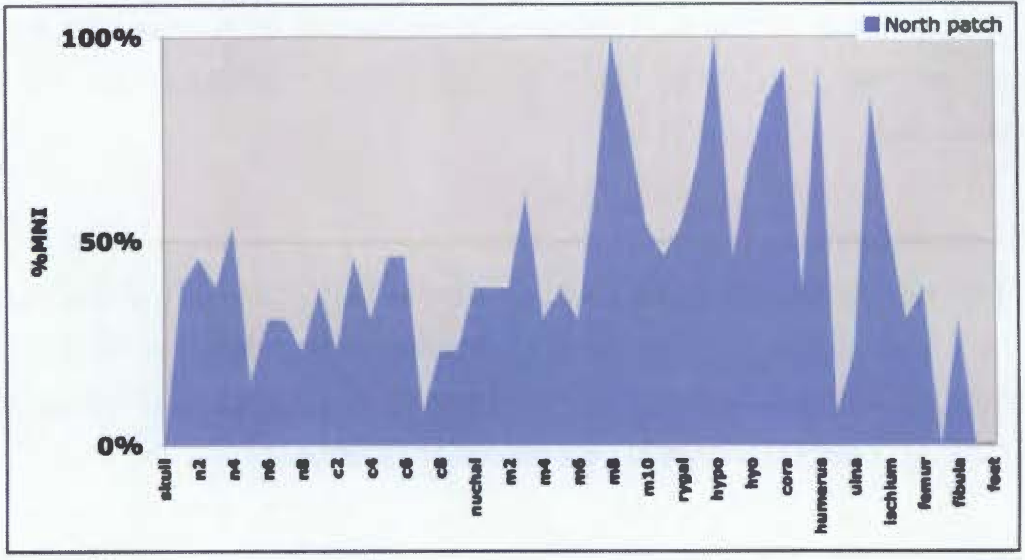
African penguin (Spheniscus demersus)

There are four bones identified to African penguin, representing a minimum of one individual. The bones consist of a rib, a scapula, and two vertebrae.

Angulate tortoise (Chersina angulata)

There are 581 tortoise bones representing at least thirteen individuals. A total of 163 elements could only be identified as carapace fragments. The majority of the elements are present (Fig. 10.8), but the skulls and toe bones are noticeably absent. This is a pattern identified at other Later Stone Age sites in the Namaqualand region (personal observation) and is explained either by: the inability of the sieves to pick up such small bones; the heads and toes being removed and taken/left elsewhere; or these small bones are being consumed.

Figure 10.8 The element distribution of angulate tortoise for the north patch at LK5-1. MNI (100%)= 13. Note the lack of skull and phalanges. C=carapace, N=neural, M=marginal



As expected, the dense plastron is well represented while the carapace is missing elements, clearly accounted for in the fragmented category. A total of 96 carapace bones are burnt compared to only eight plastron, and two long bones (Table 10.5) elements, suggesting that the carapaces are being exposed to direct flame more often than the plastron or limb bones. In square C4, an articulated carapace was identified with all elements but the neurals and anterior carapace bones (Fig. 10.2). In addition, while not articulated, square E4 had the elements of three whole tortoises. Fourteen humeri produced a mean humeral breadth of 6.1±0.4mm with a range from 5.2-6.8mm and eight femora produced a mean distal breadth of 6.3±0.8mm with a range from 5.2-7.3mm.

Table 10.5 Heat alteration of angulate tortoise bone at LK5-1

Occupation	Elements	No.
North patch N=581	carapace	96
	plastron	8
	limbs	4
East patch N=601	carapace	103
	plastron	18
	limbs	2
South patch N=63	carapace	27
	plastron	0

	limbs	0

Fish

There are three bones identified to fish, two cranial fragments and a vertebra.

Medium snake

A skull bone and a vertebra were identified to medium snake the size of a berg adder (*Bitis atropus*).

Bone modification

There are very few bones in the north patch that show any form of modification (Table 10.6). Only three bones or 0.2% of the assemblage have cut marks and 129 or 10.5% show evidence for heat alteration. There is no evidence for carnivore or rodent gnawing on the bone assemblage. There are 31 long bones with spiral fractures, indicative of secondary processing for bone marrow, while one bone has a dry transverse break (Johnson1985, Lyman 1994). There is also no evidence of weathering or exposure of the bone to the elements (Behrensmeyer 1978). The lack of carnivore modifications and weathering suggests that the site was rapidly buried after it was abandoned.

Table 10.6 Modifications identified on bone from LK5-1

Modification	North patch (N=1224)		East patch (N=253)		South Patch (N=295)	
	No.	%No.	No.	%No.	No.	%No.
Cut marks	3	0.2	1	0.4	0	0
Burnt	129	10.5	130	51.3	39	13.2
Carnivore gnawing	0	0	2	0.8	0	0
Spiral breaks	31	2.5	78	30.8	1	0.3
Transverse breaks	1	0.08	0	0	0	0
Weathering	0	0	13	5.1	3	1.0

East Patch

The east patch contained 1,021 bones weighing 1,091.7g, with 768 elements (75.2%) identified to species or size class. The most abundant species is angulate tortoise with at least 13 individuals, followed by a minimum of two steenbok. The remaining species are represented by a single individual: BovII, Cape hare (*Lepus capensis*), wild cat, Cape fur seal, micromammal sp., small mammal, small-medium mammal, medium mammal, and a frog sp.

Steenbok (Raphicerus campestris)

There are twenty elements identified to steenbok, representing a minimum of two individuals. The elements consist of skull bones, foot bones, and a few ribs. The presence of two left horn cores identifies these two animals as male. The presence of heads and toe bones suggests that the animals underwent primary butchery at this patch but that the high utility bones and best cuts of meat were removed.

BovII (springbok or grey duiker)

There are eight elements identified to a bovid size class II individual. There is a range of elements including teeth, metapodials and vertebrae, but they are heavily fragmented.

Cape hare (Lepus capensis)

A mandible and a maxilla were identified to Cape hare.

Wild cat (Felis lybica)

There is a left mandible identified to wild cat.

Cape fur seal (Arctocephalus pusillis)

A single adult post-canine identifies the presence of a Cape fur seal.

Micromammal sp.

There are eight micromammal bones, representing one individual. These elements include six skull bones, teeth, a humerus, and an innominate.

Small mammal

There are 120 elements identified to small mammal consisting entirely of long bone shaft fragments, ribs, and vertebral fragments. Considering the highly fragmented nature of the bones in this category, it is likely that they are the missing steenbok, hare, and wild cat bones.

Small-medium mammal

Two unfused cervical vertebral fragments could be identified only to small-medium size mammal.

Medium mammal

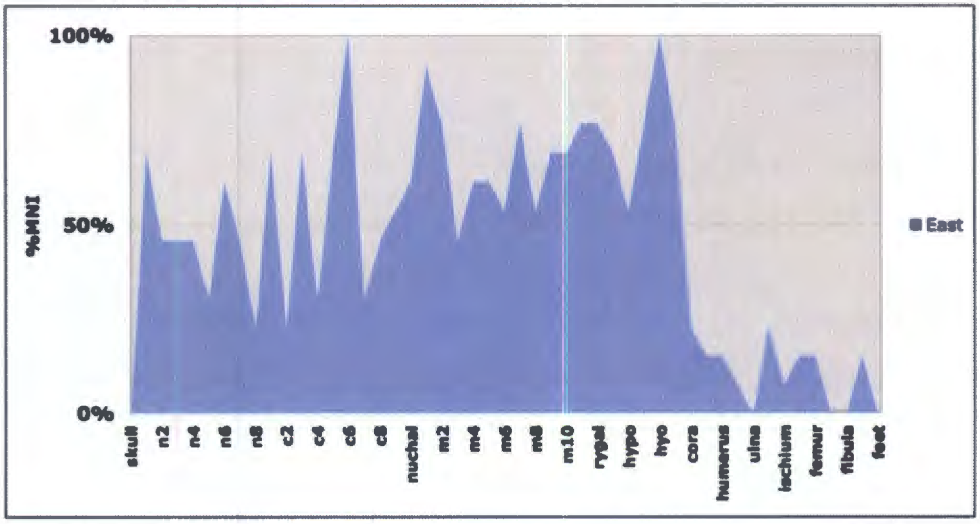
There are three medium size mammal rib fragments.

Angulate tortoise (Chersina angulata)

There are 601 tortoise elements representing a minimum of 13 individuals. A total of 151 elements could only be identified as carapace fragment and another two could only be identified as neurals. The majority of elements are present (Fig. 10.9), but there is a noticeable paucity of skull and foot bones. Limb bones are also poorly represented. Out of 124 burnt tortoise elements, 103 are carapace, 18 are plastron, and two are femora (Table 10.5). This suggests that the carapace is being exposed to direct flame more often than the plastrons. In square Q5 there are the elements for five plastrons, three posterior carapaces, and the limbs from two individuals. In square R5 there are the remains of six individuals, but the corresponding limbs for only one individual (Fig. 10.2).

A total of three humeri have the same distal breadth at 5.9mm and there is only one femur, which is 6.8mm in breadth.

Figure 10.9 **The element distribution of angulate tortoise for the east patch of LK5-1. MNI (100%)= 13. Note the lack of skull or phalanges. C=carapace, M=marginal, N=neural**



Frog

There are two bones identified to frog, a tibiofibula and a radioulna.

Bone modification

There is minimal evidence for human modification of the east patch bone assemblage (Table 10.6): one bone has cut marks and another 130 or 51.3% of the assemblage show evidence for heat alteration. This is a high frequency of burnt bone considering that there was no evidence for a hearth. A total of 78 long bones or 30.8% of the assemblage had fresh green spiral breaks indicative of secondary processing of bones for access to marrow (Table 10.5). Carnivores were present but only two bones showing gnaw marks. The assemblage was also exposed to the elements for some time as 13 bones or 5.1% of the assemblage shows stage 1 weathering (Behrensmeyer 1978).

South patch

There are 295 elements weighing 72.4g, with 92 (31.2%) bones identified to species. The most abundant species is micromammal sp. with at least two individuals followed by a minimum of one steenbok, Cape fur seal, African penguin, angulate tortoise, frog, and medium snake.

Steenbok (Raphicerus campestris)

There are five elements identified to steenbok, representing at least one individual. The bones consist of a mandible, ulna, patella, and two molars. The mandible is from a yearling (~12months old) as the third molar is just completing eruption (Manson 1984).

Cape fur seal (Arctocephalus pusillus)

There is a single incisor from an adult Cape fur seal.

Micromammal sp.

There are ten elements identified to micromammal sp., representing a minimum of two individuals. There are three mandibles, a maxilla, molar, two incisors, two vertebrae, and an innominate.

Small mammal

A total of nine fragmented elements could be identified only to small mammal. The bones consist of long bone shaft fragments, a vertebra, a calcaneus, and a mandible.

African penguin (Spheniscus demersus)

There is a radius of an African penguin.

Angulate tortoise (Chersina angulata)

There are 63 elements identified to angulate tortoise, representing at least one individual. A total of 54 fragments could be identified only to carapace fragment. There are no plastron bones. All 27 burnt bones are carapace (Table 10.5), supporting the idea that the animals were placed on the fire upside down.

Frog

There are two radioulnae identified to frog, representing a minimum of two individuals.

Medium snake

There is a vertebra identified to medium size snake such as a berg adder.

Bone modification

There is minimal evidence for human modification to the bone assemblage (Table 10.6: 39 bones or 13.2% of the assemblage show heat alteration and one long bone has a spiral fracture. There is no evidence for carnivore activity. The south patch was exposed to the elements at some point as three bones show evidence for stage 1 weathering (Behrensmeyer 1978).

Crayfish (Jasus lalandii)

The north patch has a total of 452 crayfish mandibles with an MNI of 243 individuals based on right mandibles. 110 or 24.3% of the mandibles are fragmented. The mean length of the right mandibles is 12.6± 2.8 mm with a range of 8.0-21.7mm. The mean length of left mandibles is 13.1±2.6mm with a range from 6.4-20.9mm. Following Jerardino *et al.* (2001) the mean carapace length based on the right mandible is 86.9±15.4mm with a range from 46.9-134.9mm. The mean carapace length based on the left mandible is 89.5±17.7mm with a range from 60.2-146.3mm.

The east patch has a total of 172 mandibles with an MNI of 103 individuals based on right mandibles. 30 or 17.4% are fragmented. The mean length of right mandibles is 14.0±2.9mm with a range from 9.7-21.6mm. The mean length of left mandibles is 13.6±2.9mm with a range from 8.1-19.4mm. Following Jerardino *et al.* (2002), the mean carapace length is 92.7±17.7mm with a range from 66.7-138.3mm based on right mandibles and 95.1± 18.5mm with a range from 60.8-131.9mm based on left mandibles.

The south patch has a total of 179 mandibles with an MNI of 90 individuals based on right mandibles. 34 or 18.9% of the mandibles are fragmented. The mean length of right mandibles is 12.6±2.4mm with a range from 9.2-19.4mm. The mean length of left mandibles is 12.5±2.6mm with a range from 8.5-18.7mm. Following Jerardino *et al.* (2002), the mean carapace length is 84.0±14.6mm with a range from 63.7-125.0mm based on right mandibles and 88.2±16.5mm with a range from 63.3-127.5mm based on left mandibles.

On average, the smallest crayfish come from the east patch and the largest from the south patch; However this is not statistically significant (t-test between means of East-South =2.43, p>0.0169, df=93).

Shellfish

As the volume of shellfish was high at LK5-1, the shellfish was sub-sampled. The north patch has a sample from two m^2 and the east patch sample is from $1m^2$. Unfortunately there is no sample from the south patch.

The north patch is dominated by the limpet species *Cymbula granatina* (39.8%), *Scutellastra granularis* (38.2%), and *S. argenvillei* (15.5%). Other species present in the sample are *Choromytilus meridionalis*, Whelk sp., *Crepidula fornicata, Aulacomya ater,* and *S. barbara* (Table 7). The east patch consists of the same range of species but in different frequencies, here *S. granularis* dominates at 52.7%, followed by *C. granatina* (38.2%), and *S. argenvillei* (7.0%). While all species are edible the whelks (*Oxystele* and *Burnupena?*), *C. fornicata,* and *A. ater* are relatively small species that most likely arrived at the site unintentionally.

Table 10.7 **The shellfish species identified at LK5-1. Due to the lack of shellfish data for the south patch, it is not included in this table**

Taxon	North patch		East patch	
	MNI	%assemblage	MNI	%assemblage
C. granatina	267	39.8	473	38.2
S. granularis	256	38.2	652	52.7
S. argenvillei	104	15.5	87	7.0
C. meridionalis	33	4.9	11	0.9
Whelk sp.	5	0.7	7	0.6
Crepidula fornicata	2	0.3	2	0.2
Aulacomya ater	2	0.3	5	0.4
S. barbara	1	0.2	1	0.1
Total	**670**		**1238**	

Table 10.8 **The mean length and other relative statistics for the dominant shellfish species at LK5-1. Due to the lack of shellfish data from the south patch, it is omitted in this table**

Patch	Taxon	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
North	*C. granatina*	79	54.9	10.2	34.9	75.1
	S. granularis	159	37.0	5.2	24.1	49.7
	S. argenvillei	82	69.2	14.7	16.3	85.5
	C. meridionalis	33	61.9	8.1	45	79
East	*C. granatina*	204	55.2	9.1	15.1	74.1
	S. granularis	351	36.2	5.8	13.6	53.3
	S. argenvillei	45	61.6	16.9	15.6	82.5
	C. meridionalis	7	65.7	12.9	57	92

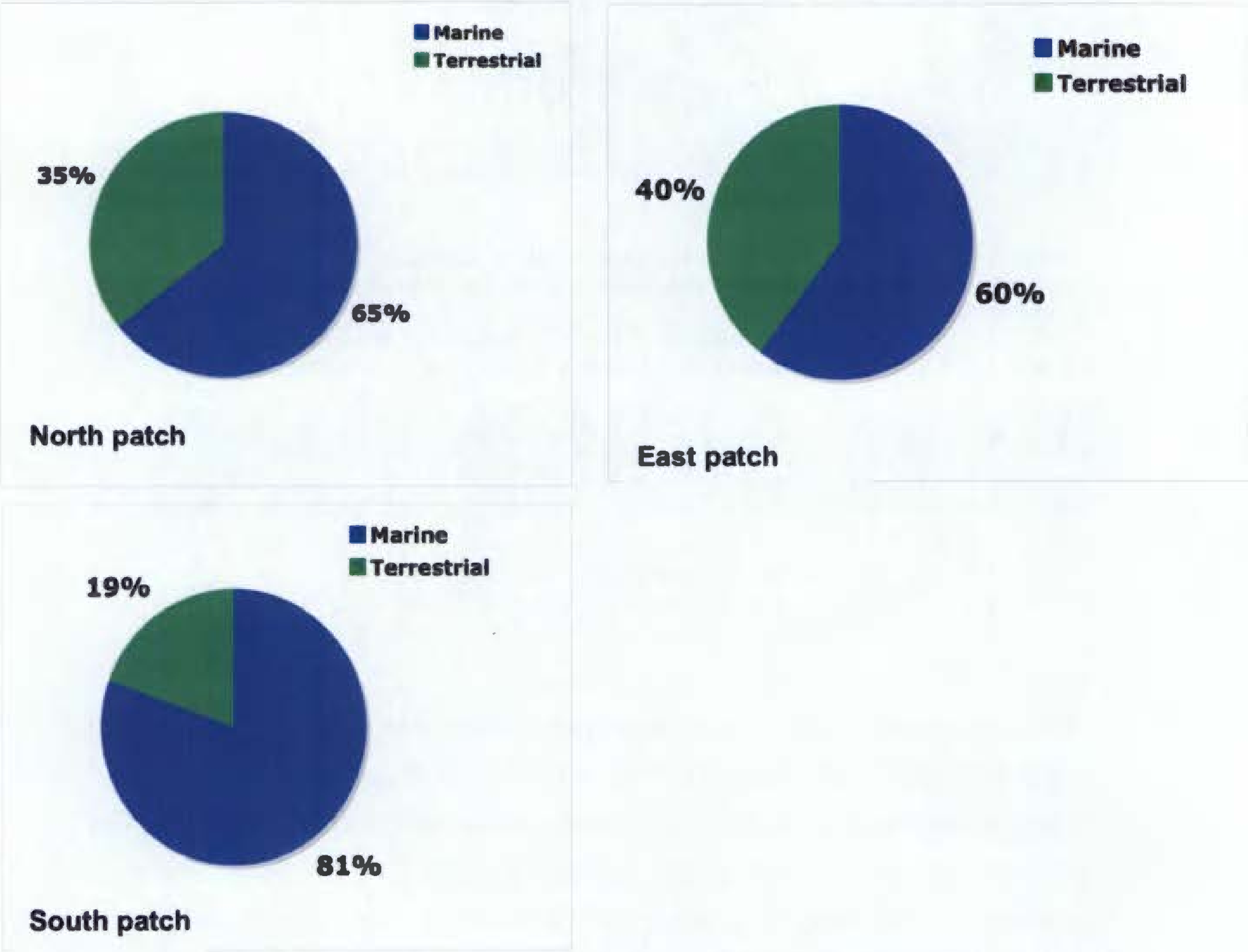
The mean lengths for the measurable species were also recorded. In the north patch the mean length is: *C. granatina* 54.9±10.2mm, *S. granularis* 37.0±5.2mm, *S. argenvillei* 69.2±14.7mm, and *C. meridionalis* 61.9±8.1mm (Table 10.8). The mean length of the south patch shellfish is similar to the north patch: *C. granatina* 55.2±9.1mm, *S. granularis* 36.2±5.8mm, *S. argenvillei* 61.6±16.9mm, and *C. meridionalis* 65.7±12.9mm (Table 10.8).

Kilojoules

The kilojoules available in the north patch are dominated by marine species (Fig. 10.10) at 65% of the total. The principal species is Cape fur seal at 25%, followed by BovII at 20%, and crayfish at 17% (Fig. 10.11). *C. granatina* is also an important resource providing 10% of the total available kilojoules, while combining the shellfish accounts for 20.5% of available kilojoules in the north patch (Table 10.9).

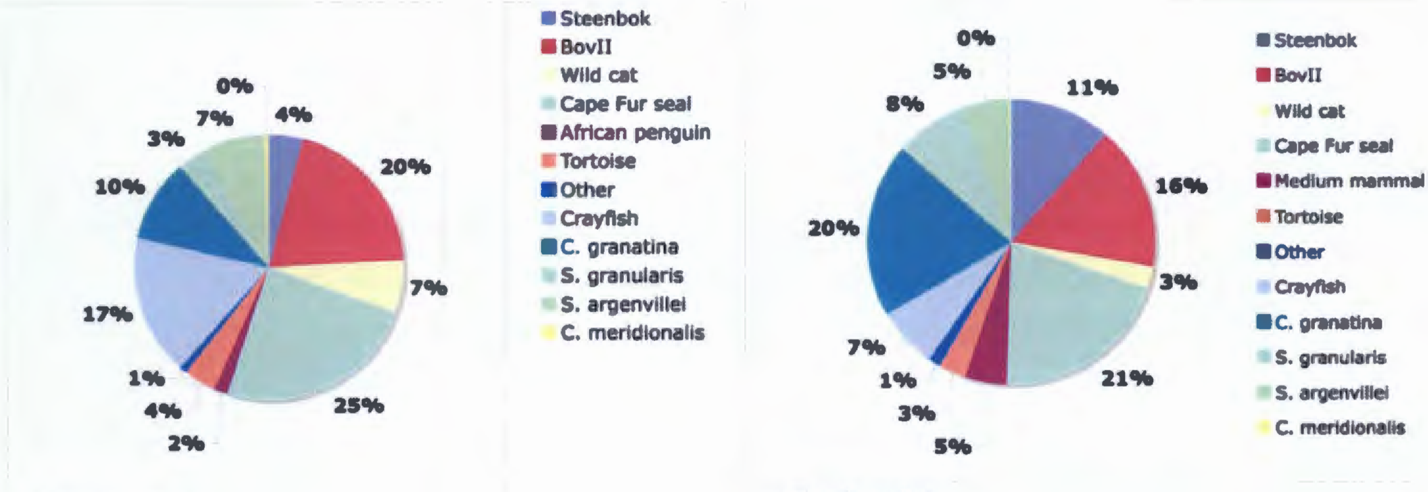
The east patch is dominated by marine kilojoules at 60% (Fig. 10.10). The foremost species contributing to the diet is Cape fur seal at 21% of the available kilojoules, followed by *C. granatina* at 20%, and BovII at 16% (Fig. 10.11). Other important contributing species are steenbok, crayfish, and *S. granularis*. In total, the shellfish contributes 33.2% of available kilojoules in the east patch (Table 10.9).

Figure 10.10 **The ratio of terrestrial versus marine kilojoules at LK5-1. The top left pie chart is for the north patch, the top right chart is for the east patch, and the bottom chart is for the south patch. Note that there is no data for shellfish in the south patch**



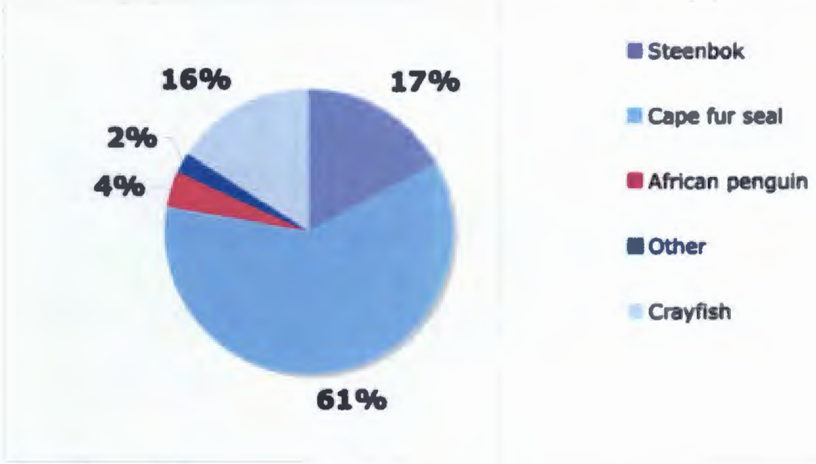
The south patch lacks shellfish data, but is nonetheless dominated by marine species at 81% of available kilojoules (Fig. 10.10). If the shellfish data had been included, the few terrestrial species such as steenbok, snake, and micromammals could be negligible. The foremost species contributing kilojoules is Cape fur seal at 61% of the assemblage, followed by steenbok at 17%, and crayfish at 16% (Fig. 10.11 & Table 10.9).

Figure 10.11 **The distribution of kilojoules at LK5-1 by species. The top left pie chart is the north patch, the top right is the east patch and the bottom chart is the south patch. Note that there is no data for shellfish in the south patch**



North patch

East patch



South patch

However, while Cape fur seal is the dominant species in all three patches, only one tooth represents each animal. If the teeth were brought to the patches for purposes other than subsistence, then the kilojoule distribution would be different. This is relevant because it is common to find a single Cape fur seal tooth or mandible at Later Stone Age sties along the Namaqualand coast (personal observation).

Without Cape fur seal, the ratio of kilojoules at the north patch would shift to 54% marine and 46% terrestrial (Fig. 10.12), with BovII at 25%, crayfish at 23%, and *C. granatina* at 13% (Fig. 10.13). The overall contribution of shellfish to the overall diet would then be 29%.

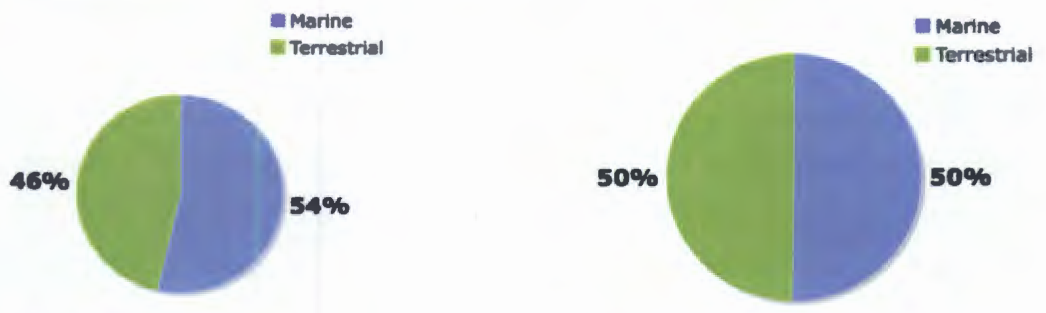
The east patch would shift to an equal ratio of kilojoules at 50% marine, 50% terrestrial (Fig. 10.12), with C. granatina at 26%, BovII at 20%, and steenbok at 14%. The shellfish contribution would increase to 42% of the overall diet (Fig. 10.13).

The south patch would also shift to a nearly equal ratio with 51% marine and 49% terrestrial kilojoules (Fig. 10.12), with steenbok at 44%, crayfish at 40%, and penguin at 10% of the available kilojoules (Fig. 10.13). Again, the lack of shellfish data prevents the determination of their contribution to the diet.

Table 10.9 The kilojoules available from LK5-1. Due to the lack of shellfish data for the south patch, there is no kilojoule data for the south patch shellfish

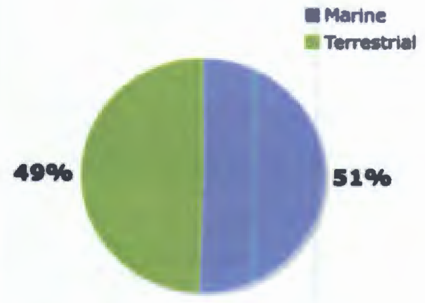
Taxon	North patch			East patch			South patch		
	Number of animals	KJ /animal	Total KJ	Number of animals	KJ /animal	Total KJ	Number of animals	KJ /animal	Total KJ
Steenbok	1	28,200	28,200	2	47,000	94,000	1	47,000	47,000
BovII	1	134,150	134,150	1	134,150	134,150	0	0	0
Cape hare	0	0	0	1	9,800	9,800	0	0	0
Wild cat	2	22,040	44,080	1	22,040	22,040	0	0	0
Cape Fur seal	1	165,000	165,000	1	165,000	165,000	1	165,000	165,000
Micromammal	2	1,000	2,000	1	1,000	1,000	2	1,000	2,000
Medium mammal	0	0	0	1	40,000	40,000	0	0	0
African penguin	1	11,160	11,160	0	0	0	1	11,160	11,160
Tortoise	13	2,000	26,000	13	2,000	26,000	1	2,000	2,000
Fish	1	1,000	1,000	0	0	0	0	0	0
Medium snake	1	1,000	1,000	0	0	0	1	1,000	1,000
Frog	0	0	0	1	1,000	1,000	1	1,000	1,000
Crayfish	243	480.4	116,737.2	103	560.4	57,721.2	90	480.4	43,236
C. granatina	1,969	34.4	67,733.6	4,730	34.4	162,712	/	/	/
S. granularis	1,888	12.3	23,222.4	6,520	10.4	67,808	/	/	/
S. argenvillei	767	65.3	50,085.1	870	48.5	42,195	/	/	/
C. meridionalis	243	13.5	3,280.5	110	15.5	1,705	/	/	/

Figure 10.12 The ratio of terrestrial versus marine kilojoules at LK5-1not including Cape fur seal



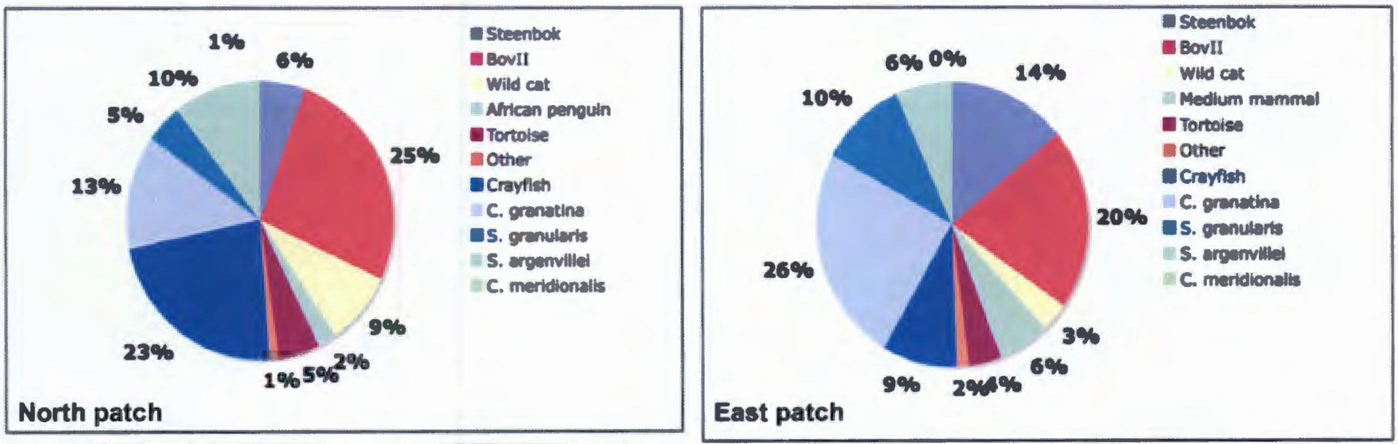
North patch

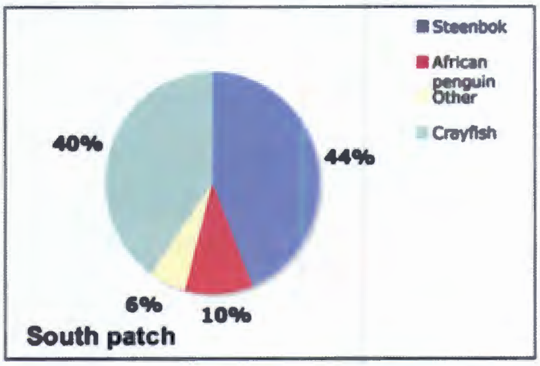
East patch



South patch

Figure 10.13 The distribution of kilojoules at LK5-1 by species, not including Cape fur seal





Discussion and conclusion

LK5-1 is located 72m from the coastline of the Atlantic Ocean. A prospecting trench cuts through the north end of the site that seems to have been a streambed and potential source of fresh water. There are three discrete shell patches, each with a single occupation layer. The majority of the identified stone is probably local with the exception of the red ochre whose source is unknown.

Ostrich eggshell is very common in the region and is easily collected either whole or as fragments from an abandoned nest. However, the very low frequencies of eggshell from all three patches suggest that people were collecting pieces rather than whole shells. The species of faunal remains are more or less the same at all three patches, suggesting similar subsistence strategies with all three patches dominated by marine kilojoules. The majority of the species present in the three patches are predictable, plentiful, and easily collected. The exceptions are the Cape fur seal and African penguin, which may have been scavenged when washed up on shore.

A note should be made regarding the Cape fur seal as while they are present in all three patches, it is by a single tooth in each case. It is possible that the teeth of the seals are important and for some symbolic reason, they are being brought to the site. A similar pattern was identified at two other sites SK400 and TP2004-04, but at these sites, Cape fur seals are represented by single toothless mandibles. If the Cape fur seal is not contributing to the diet, then the ratio of marine to terrestrial kilojoules is roughly even at all patches (not including the shellfish at the south patch).

North patch

The north patch consists of 14.75m^2 dated at roughly 383AD. While there seems to be five separate piles of shell, the distribution of the archaeological material is most densely concentrated in the large dump at the north end of the patch. Artefact types present in this patch consist of lithics both formal tools and debitage, ostrich eggshell body fragments, bone refuse, crayfish mandibles, and shellfish.

The formal tools are few and consist of a scraper and a fragment of a backed bladelet on quartz crystal and two backed scrapers made on CCS. Backed scrapers are typically part of a mid-Holocene tool kit, and it is interesting to find it at a late Holocene site, although they could represent heirlooms. The presence of hammerstones, cores, and debitage identifies lithic processing activities at this patch. The presence of grindstones and ochre suggest that grinding activities occurred at this patch, although there is no direct evidence i.e. there is no ochre staining on the grindstones and the ochre does not have evidence for use wear. Also of interest is the potential for a tortoise burial in the middle of the main dump, which is a common occurrence in this region (personal observation). There is a very small collection of ostrich eggshell body fragments with only one flask mouth fragment. The subsistence strategy is one focussed on marine species as they dominate the available kilojoules at two thirds of the assemblage. In addition to subsistence, the secondary products of these animals, the furs and skins would have been important. If the snake is a berg adder, it may have been collected for its poison, however the skull bones were present which is unusual (personal observation). The shellfish assemblage has a wide range of species including the major limpet species, black and ribbed mussels, and some whelks. The presence of the black mussel, granular, and granite limpets identify the exploitation of the mid inter-tidal zone, which can be harvested during any low tide. The presence of the Argenvillei limpets means that people exploited the low inter-tidal zone, which is only accessible near or during a spring low tide, narrowing the time frame that the patch was occupied.

East Patch

The east patch consists of 10m^2 dated to roughly 411BC. There is a single dump of in situ shell midden on the east side of the patch, which is where the dense concentrations of artefacts are found.

There are four formal tools made on fine-grained material, a scraper and a backed scraper on quartz crystal and a segment and thumbnail scraper on CCS. The presence of cores, debitage, and a hammerstone identifies that lithic processing activities occurred in this patch. While there is an upper grindstone there is no lower grindstone, nor ochre or any other material such as roots or bulbs that are associated with grinding, thus it is difficult to determine if grinding occurred at this occupation. The ostrich eggshell assemblage is small with only four fragments. The subsistence strategy is focussed on marine species. The shellfish consists of the same range of species as the north patch, but in this case, *S. granularis* dominates the limpets over *C. granatina*. Again, the presence of *S. argenvillei* narrows the time frame of the occupation of the east patch to near or during a spring low tide.

South Patch

The south patch consists of 6m^2 and is most likely less than 2000 years old based on the presence of pottery. There is no in situ shell midden per se, which unfortunately prevented the collection of a sub sample of shellfish for further analysis. Artefacts present in this patch are lithics, pottery, ostrich eggshell body fragments and beads, bone refuse, crayfish, and some shellfish.

There is one formal tool a backed scraper on CCS, which is of interest as backed scrapers are usually associated with mid-Holocene sites yet the pottery suggests this patch is much younger. In addition there is a nodule of red ochre. While there are no hammerstones, the presence of debitage and cores suggests that lithic processing activities occurred at this patch. There is no evidence for grinding activities.

The pottery identified in the south patch consists of eight sherds from a minimum of one pot, without decoration. Four of the sherds are rims with a rounded lip. There are three ostrich eggshell beads that are moderate in size.

The subsistence strategy focussed on marine species, providing over 80% of the available kilojoules, not including the contribution from shellfish. Marine kilojoules dominate the assemblage even though the shellfish is not included. The medium snake was potentially collected as a source of poison. Unfortunately a sub sample of shellfish was not collected for this patch.

Overall, there are more similarities between these patches than there are differences; they more or less share the same raw materials, tool forms, and subsistence strategies. They have the same low frequency of ostrich eggshell and high frequencies of crayfish. However, the south patch is different from the north and east patches as pottery and ostrich eggshell beads are present in this patch, it lacks large numbers of tortoises, and has a much higher reliance on marine foodstuffs.

Chapter Eleven: LK2004-011-The Penguin Midden

Figure 11.1 **Facing west, before excavation, showing in situ shell midden of LK2004-011 truncated by prospecting trench. The black star shows the location of the burial**

Introduction

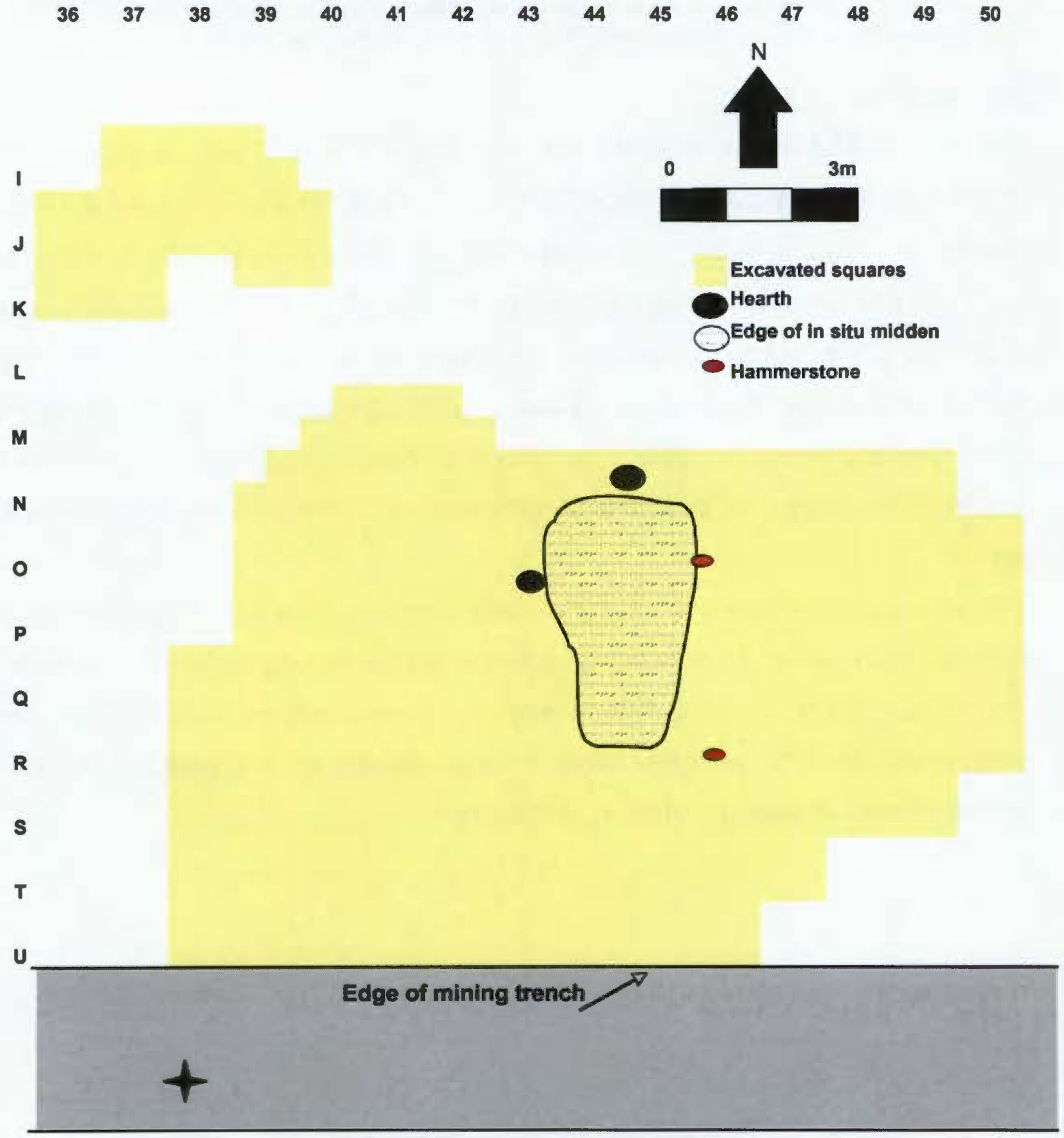
The site LK2004-011, also known as "the penguin midden" is an open-air shell midden on top of a partially vegetated mobile dune, 60 m east of the Atlantic Ocean, in Namaqualand, South Africa (Fig. 1.5) (30° 22' 10.1"S 17° 18' 01.7"E). The dune is located on the south side of a large mobile dune sea (Fig. 1.5). The penguin midden is truncated by a large trench (Figs. 11.2 &11.3), a remnant of previous prospecting for diamonds within the DeBeers Namaqualand Mining Company, Koignaas complex (KNC). The nearest rivers are the Swartlinjies 12.2km to the north and the Spoeg River 12.6km to the south.

The site was identified in 2004 by the Archaeology Contracts Office (Orton & Halkett 2005) while conducting an archaeological survey within a potentially rich mining block. As DeBeers planned to re-open and expand the old prospecting trench, we excavated a large sample of the penguin midden ahead of the possible destruction of the site.

Excavation

The site was excavated using standard methods including trowels, pans, buckets, a 3 mm sieve, and a 1.5mm sieve. For the majority of the excavation we were able to use the 1.5mm sieve to ensure we collected the smallest beads, but heavy rains made this difficult and some squares had to be sieved using only the 3 mm sieve. The whole site including the in-situ shell midden and immediate surroundings were excavated in 25cm^2 while the deflated areas were excavated in 1m^2 (Fig. 11.2). 103.25 m^2 were excavated for a total volume of 3.02m^3.

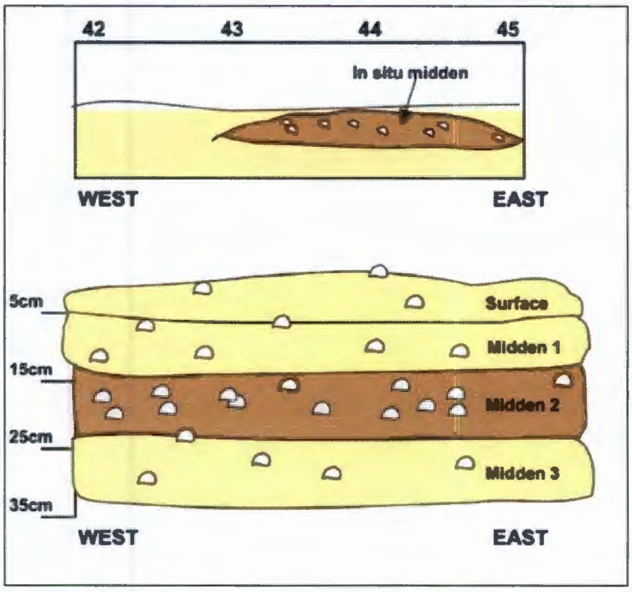
Figure 11.2 **Plan of LK2004-011. The plan shows the position of the excavation relative to the old prospecting trench and a black star indicates the location of the human remains**



Stratigraphy

Typical of shell middens in this region (personal observation), the surface scatter was 15m in diameter but the in-situ shell midden was a small discrete area 2x4m. The penguin midden was excavated as three stratigraphic units based on gradual changes in density of material and colour of the matrix (Fig. 11.3). The surface was 4cm thick, midden 1 ranged from 4-8cm thick, midden 2 ranged from 2-12cm thick, and midden 3 ranged from 3-10cm thick for a maximum depth of 34cm. In the end, the differences between the stratigraphic units are seemingly due to bioturbation as bones from different layers can be refitted (i.e. epiphyses and long bones). In the analysis of this site, the data from the three stratigraphic units were therefore lumped together due to: mole activity mixing the deposit; the inability to identify separate layers in some squares; and the refitting of some long bones. It is very likely that all the material in fact derives from a single occupation.

Figure 11.3 Schematic profile of LK2004-011. Facing north, the profile shows the intersection between rows P and Q. The close up of the midden stratigraphy is from square 44, intersection of rows P and Q



Human remains

In addition to the archaeological site, human remains were found on the north slope of the mining trench, adjacent to the site (Fig 11.1). The remains consist of a left and right femora as well as a left tibia that were heavily bleached and weathered by the sun. The bones were collected and radiocarbon dated. Unfortunately, we could not locate the burial site, or the rest of the remains. It is possible that the burial is some how linked to the midden; it was probably disturbed during the excavation of the prospecting trench.

Features

Two hearths were identified in the site and the sand beneath the hearths had been rubified (Fig. 11.2). Hearth A is on the north end of the in-situ midden, and is nearly circular at 36 cm in length (north-south) and 33 cm in width (east-west). Hearth B is on the northwest side of the midden with a length of 50 cm (east west) and a width of 45 cm (north-south) (Fig. 11.6). Both hearths consisted of large pieces of charcoal and recent rootlets. The charcoal was collected in their entirety for future identification of the plant species.

Radiocarbon dates

Three radiocarbon dates were obtained for the site, including one for the human remains. The lowest layer, midden 3 returned a radiocarbon date of 1080±50BP (GX-32059), calibrated the date is 1431AD (1404-1456AD) based on marine shell. The topmost layer midden 1 returned a radiocarbon date of 1200±60BP (GX-32057), calibrated the date is 1327AD (1296-1397AD) based on marine shell. Bone collagen from the human burial, yielded a radiocarbon date of 800±70BP (GX-32523), calibrated the date is 1273AD (1055-1392AD). These dates overlap with one another at two standard deviations. The shallowness of the deposit indicates that the site was used over a short period of time and it may represent a single occupation event.

Spatial distribution of archaeological material

Archaeological remains present at the site consist of lithics, ostrich eggshell fragments and beads, bone tools and food refuse, crayfish, and shellfish. Each of these categories of finds has been plotted to look for evidence of spatial patterning at the site (cf. Wadley 1987). The formal artefacts (Fig. 11.4) are primarily situated on the northwest side of the in-situ midden. The lithics generally clustered around the area of the in-situ midden, tailing off towards the southwest (Fig. 11.5).

Figure 11.4 The spatial distribution of the formal artifacts at LK2004-011. The various artifact types are shown in different colours

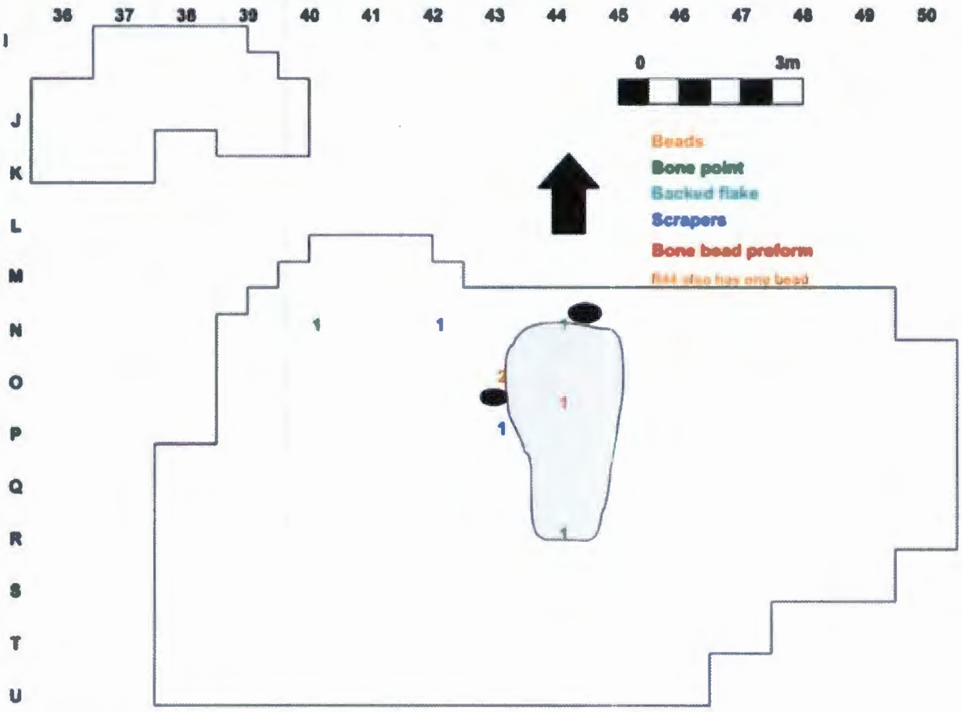
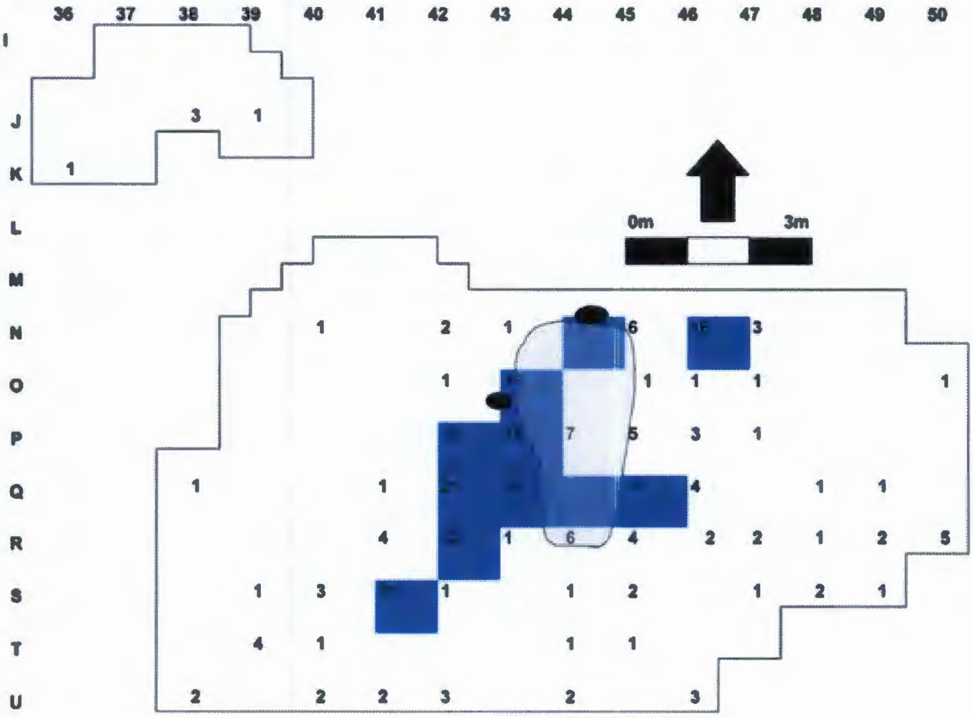
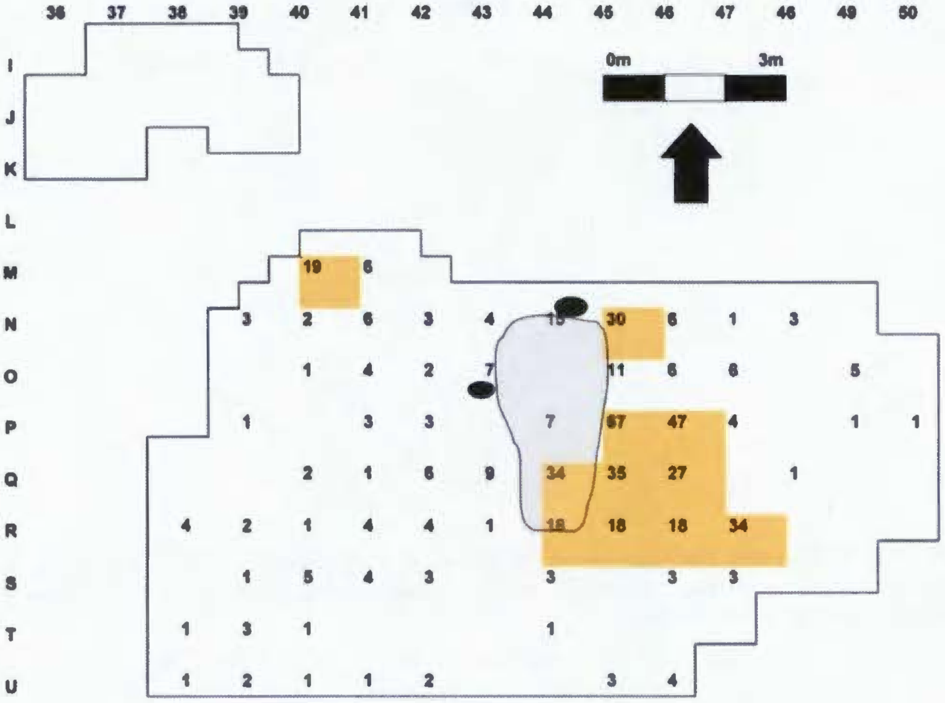


Figure 11.5 The spatial distribution of the lithics at LK2004-011. Values are number of lithics per square. Blue highlights areas of dense concentrations with values greater than ten lithics per square



The fragments of ostrich eggshell were scattered over the whole site, with two dense clusters, one at the north end of the midden and one at the southeast end of the midden (Fig. 11.6).

Figure 11.6 **The spatial distribution of the ostrich eggshell at LK2004-011. The values are number of fragments per square. Orange highlights the areas of dense concentration with values greater than ten fragments per square**



Bone is scattered across the site with a dense area in the midden and trailing to the west (Fig. 11.7). A separate plot of the distribution of the micromammal remains (Fig. 11.7) shows a different pattern, as they are more dispersed and evenly distributed. The crayfish mandibles (Fig. 11.8) are scattered across the site, but cluster in the southeast part of the midden, similar to the distribution of ostrich eggshell. While shellfish is abundant at the site, it was sub-sampled and so there is no data on the distribution of the shellfish species.

There are two main dumping areas, to the west of the midden that includes the formal artefacts, the lithics, and the majority of the bone, and to the east, which contains the ostrich eggshell and crayfish mandibles. Perhaps the western area was a working area, while the east area was the refuse dump.

Figure 11.7 **The spatial distribution of bone at LK2004-011. The values are number of bones per square. Green highlights areas of dense concentrations with values greater than 100 bones per square. The lower map shows the scattered distribution of micromammal remains, also by number of bones per square**

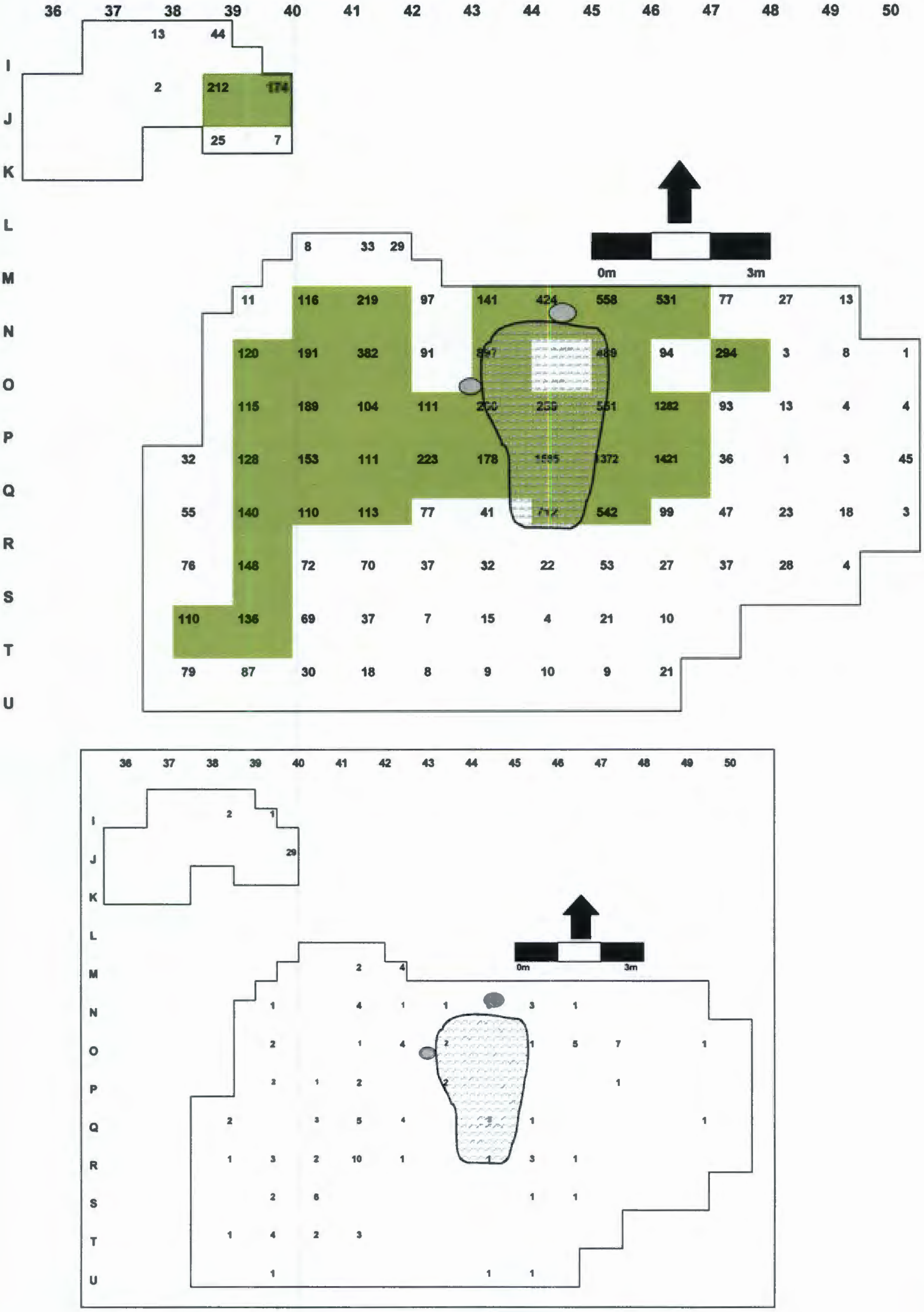
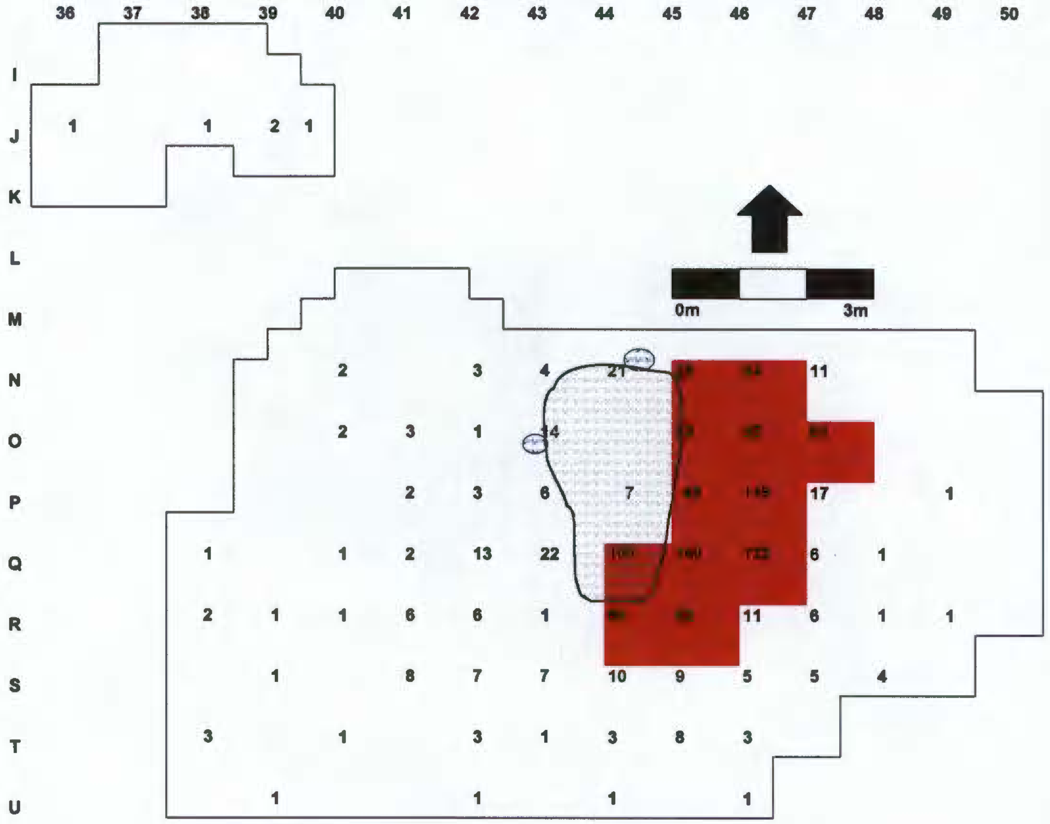


Figure 11.8 The spatial distribution of crayfish mandibles at LK2004-011. The values are number of crayfish mandibles per square. Red highlights areas of dense concentration with values greater than 25 mandibles per square



Lithics

Table 11.1 Lithic raw materials used at LK2004-011

Stone	No.	%No.
Quartz crystal	168	57.9
Quartzite	77	26.5
Black CCS	38	13.1
Other	7	2.4
Total	**290**	**100**

The stone assemblage identified by Jayson Orton, consists of quartz crystal, quartzite, black cryptocrystalline silicate (CCS), and unidentified pebbles (Table 11.1). There are three formal tools, a backed flake, and two side scrapers all made on quartz crystal account for 1.0% of the assemblage (Table 11.2). Debitage consists of flakes, chunks, and chips made on quartz crystal, quartzite, and CCS. There are also bladelets on quartz crystal and quartzite, and blades on quartz crystal. In total, debitage accounts for 92.9% of the assemblage. Cores account for 3.8% of the assemblage and include irregular cores on quartz crystal, quartzite, and CCS, and a single platform core on quartz crystal (Table 11.2). There is a hammerstone and a hammerstone/ grindstone; both made on an unidentified stone.

Table 11.2 **The lithic assemblage at LK2004-011**

Stone	No.	%No.
Quartz crystal		
Sidescraper	2	0.7
Backed flake	1	0.3
Formals sub total	**3**	**1.0**
Blade	1	0.3
Bladelet	4	1.4
Flake	77	26.6
Chunk	30	10.3
Chip	45	15.5
Debitage sub total	**157**	**54.2**
Single platform core	1	0.3
Irregular core	7	2.4
Cores sub total	**8**	**2.8**
Quartzite		
Bladelet	2	0.7
Flake	46	15.9
Chunk	26	9.0
Chip	1	0.3
Debitage sub total	**75**	**25.9**
Irregular core	2	0.7
Core sub total	**2**	**0.7**
Black CCS		
Flake	27	9.3
Chunk	6	2.1
Chip	4	1.4
Debitage sub total	**37**	**12.8**
Irregular core	1	0.3
Core sub total	**1**	**0.3**
Other		
Hammerstone	1	0.3
Hammerstone/upper grindstone	1	0.3
Hammerstone/ grindstone sub total	**2**	**0.7**
Manuport	**5**	**1.7**

Quartzite is locally abundant, while the source of the CCS and quartz crystal is unclear. However, as calcrete is locally abundant, the source of the CCS may also be local, although this black form is uncommon in the region (personal observation). The source of the quartz crystal may also be local as it is a common raw material at other archaeological sites in the immediate vicinity.

Ostrich eggshell

Fragments

A total of 565 fragments of ostrich eggshell, weighing 955.4g were identified. Twenty-one pieces are flask mouth fragments, identified on the presence of a ground rounded hole and oblique angle of breakage on the inside of the aperture. One of the flask mouth fragments was complete enough to determine the original diameter of the hole, at 13.3mm. A total of 79 fragments or 14% of the ostrich eggshell is burnt. Four pieces are ground smooth on one side, and one piece is ground on three sides. Two pieces have canine puncture marks and one is wind worn.

Beads

Only three ostrich eggshell beads were present in the assemblage. The measurements of the beads are: bead 1, 5.4mm with an aperture of 2.3mm, bead 2, 5.1mm with an aperture of 2.0mm, and bead 3, 5.4mm with an aperture of 2.5mm. All the beads are circular and the hole is in the centre of the bead, suggesting that the beads were lost before they had a chance to become worn and weathered.

Shellfish artefacts

There are also two *Cowrie sp.* shells that may have grooves indicating they were strung (Fig. 11.9)

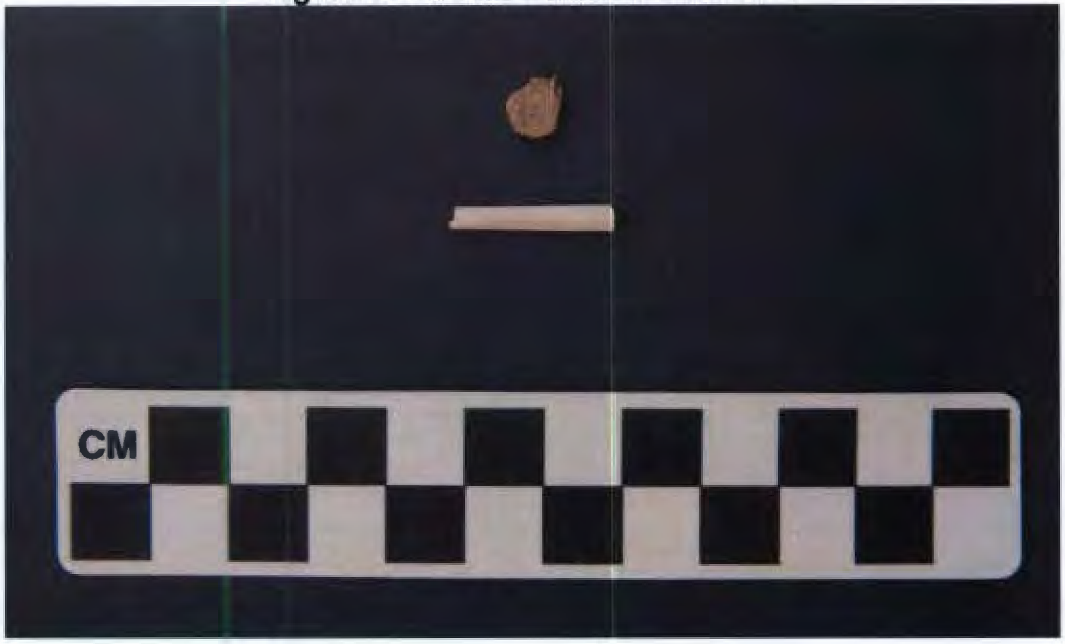
Figure 11.9 ***Cowrie*** **beads at LK2004-011**

Bone

Bone artefacts

There are two artefacts made of bone, one is a fragment of a bone point or link shaft (Schweitzer 1979), while the other is a bone bead preform (Fig. 11.10). The bone point/link shaft consists of a shaft 20.8mm long with the diameter ranging from 3.0-3.6mm. The bone bead preform is 8.2m in diameter and is still rough around the edges.

Figure 11.10 Bone artifacts at LK2004-011



Subsistence Strategy

The assemblage consists of 16,965 bones with 10,617 or 62.5% identified to species or size class (Table 11.3). The fragmentation of bone was minimal, permitting the identification of a large proportion of the assemblage. The most abundant species in the faunal sample is angulate tortoise (*Chersina angulata*), followed by African penguin (*Spheniscus demersus*). In addition, there is a broad range of species at the site, but present in much lower numbers (Table 11.3).

Steenbok (Raphicerus campestris)

There are 265 steenbok bones in the assemblage, from a minimum of 10 individuals. There are at least two newborns: the third molar in two left mandibles, and a radial epiphysis, have not fully formed. There are also five four to five month olds: the first molar is just beginning to erupt in five left mandibles (Manson 1974). There are two adult mandibles, one with heavy wear, and one with light wear, indicating an old adult and a young adult. In addition, three left horn cores identify three adult males. Steenbok breed throughout the year, but have a bimodal peak, during March and September (Skinner *et al.* 2002). While most of the elements are present, some ribs, vertebrae, the proximal humeri, the distal femora, the proximal tibiae, some of the tarsals, and the sesamoids are missing (Fig. 11.11).

Table 11.3 **The identified vertebrate species at LK2004-011**

Taxon		NISP	MNI
Steenbok	*Raphicerus campestris*	265	10
Springbok	*Antidorcas marsupialis*	1	1
Grey duiker	*Sylvicapra grimmia*	20	5
Gemsbok	*Oryx gazella*	39	1
Bovid size class ii		57	/
Bovid size class ii-iii		3	/
Wild cat	*Felis lybica*	37	3
Caracal	*Felis caracal*	1	1
Genet	*Genetta genetta*	1	1
Felis sp.		2	1
Bat eared fox	*Vulpes chama*	9	2
Canis sp.		1	1
Cape fur seal	*Arctocephalus pusillus*	4	1
Small carnivore		18	/
Medium carnivore		7	/
Cape rock elephant shrew	*Elephantulus edwardii*	2	1
Namaqua rock rat	*Aethomys namaquensis*	1	1
Hairy-footed gerbil	*Gerbillurus paeba*	1	1
Brant's whistling rat	*Parotomys brantsii*	10	1
Otomys sp.		3	1
Micromammal sp.		150	13
Small mammal		291	/
Small medium mammal		23	/
Medium mammal		56	/
Medium large mammal		63	/
Large mammal		16	/
African penguin	*Spheniscus demersus*	3,196	53
Ostrich	*Struthio camelus*	8	2
Small aves		8	1
Medium aves		189	6
Large aves		1	1
Medium fish		30	1
Large fish		11	1
Speckled padloper	*Homopus sugnatus*	28	4
Angulate tortoise	*Chersina angulata*	6,051	112
Lizard		3	2
Medium snake		4	1
Total		**10,617**	**229**

Figure 11.11 The element distribution for steenbok at LK2004-011

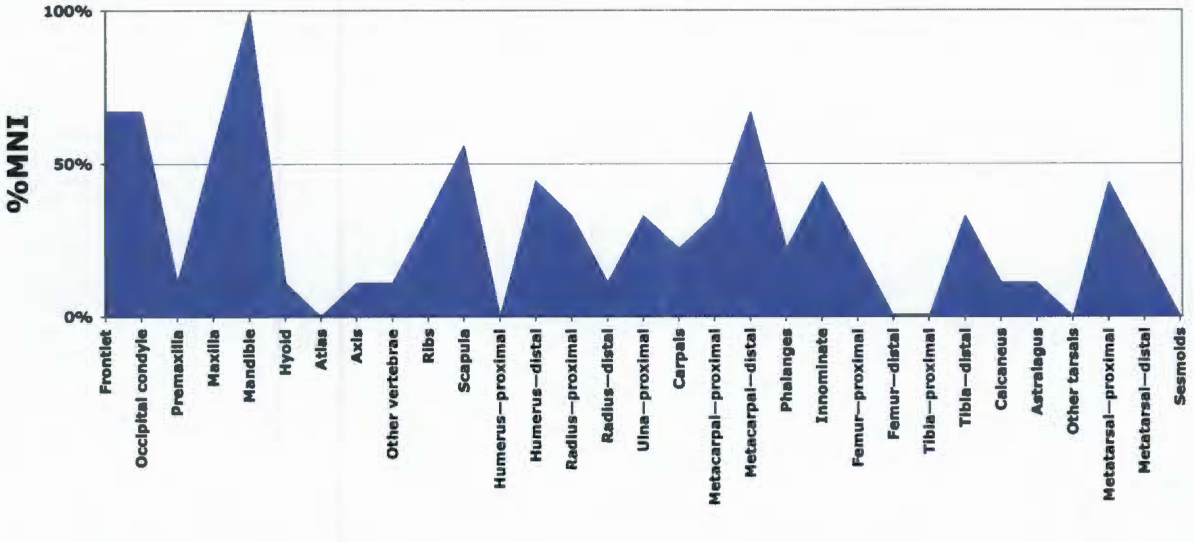
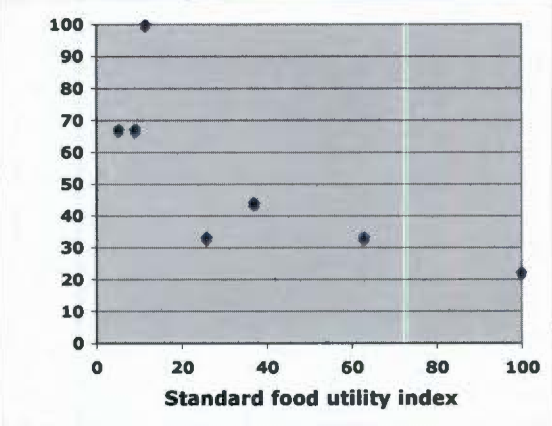


Figure 11.12 Scatterplot comparing the %MNI of steenbok elements from the Penguin Midden, LK2004-011 with the standardised food utility index. Note that only the high utility bones were used



As the sample size is substantial, quantitative measures can be applied in order to try to identify the cause of the missing bone. Plotting the %MNI of the elements against their density values (Lam *et al.* 1999, Lam *et al.* 2003, Lam & Pearson 2004) produced a weak positive correlation (Pearson's r^2=0.3). Plotting the %MNI of the high utility elements against the standardized food utility index (Fig. 11.12) (Metcalf & Jones 1985) and applying Shannon's evenness index suggests that two economic strategies are affecting the steenbok assemblage: an unconstrained strategy and a gourmet strategy

(Faith & Gordon 2006). Spearman's rho=-0.8123, p=0.0143, values associated with an unconstrained strategy of returning the whole carcass to the site (Table 11.4), but Shannon's evenness index E=0.565, which suggests a gourmet strategy (Faith & Gordon 2006). The conflict is due to the high percentage of skull bones and low frequency of high utility long bones. Thus, while the carcass was probably brought to the site whole, some of the high utility elements were removed and taken to another site following a gourmet meat strategy.

Table 11.4 The %MNI and standard food utility index for steenbok at the Penguin Midden, LK2004-011

Element	SFUI	%MNI
Femur	100.0	22
Tibia	62.8	33
Metatarsal	37.0	44
Humerus	36.8	44
Radius	25.8	33
Mandible	11.5	100
Crania	9.1	67
Metacarpal	5.2	67
N		265
Evenness		0.565
Shannon's rho		-0.8123
P		0.0143
Result		Gourmet& unconstrained

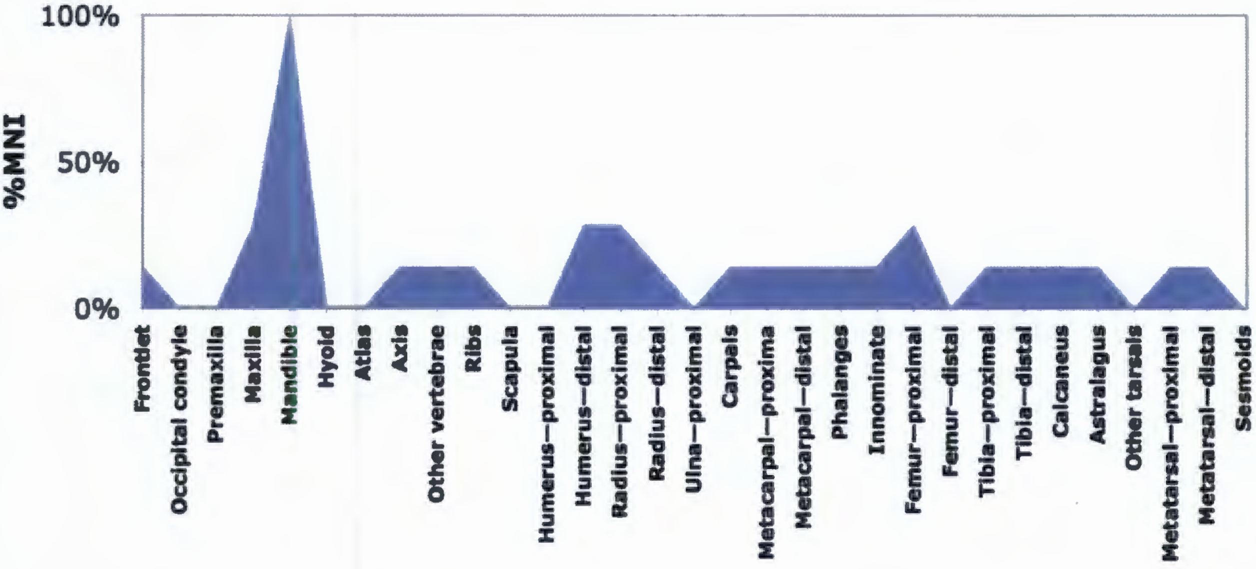
Bovid size class two Springbok (Antidorcas marsupialis) and Grey Duiker (Sylvicapra grimmia)

Springbok and grey duiker are the only species identified in this size class at LK2004-011. Sheep would also belong in this category, but the lack of identified sheep bone suggests that they are not present at the site. This means that the unidentified bovid size class two (BovII) remains are probably either springbok or duiker.

There is only one bone positively identified to springbok, an adult right maxilla.

As there is no data for the eruption rates of duiker teeth, I have used the eruption rates for springbok (Rautenbauch 1977). The duiker category consists of 25 bones representing at least five individuals: two 4-5 month olds with the first molar just beginning to erupt in two right mandibles (Rautenbauch 1977); two young adults with little dental wear; and an old adult with heavy tooth wear. The majority of the duiker assemblage consists of crania and mandibles with few long bones. However, the lack of identified long bones is most likely due to the difficulty in identifying those elements to species. There are 57 unidentified BovII bones consisting primarily of ribs, long bone fragments, vertebrae, and tarsals, which probably account for some of the missing duiker elements. For the analysis of the distribution of elements, all of the bovid size class two elements were lumped together in order to improve the size of sample (Fig. 11.13).

Figure 11.13 **The distribution of BovII skeletal elements at LK2004-011**



As the sample size is only 77 elements, quantitative analyses were not applied to the BovII assemblage due to the potential error. However, the number of skull bones is high in comparison to the high utility long bones, which suggests that high utility long bones and the best cuts of meat were taken elsewhere, leaving the low utility remains behind.

Bovid size class three

Gemsbok (Oryx gazella)

There are 39 gemsbok bones and three unidentified bovid size class II-III bones. The assemblage consists of foot bones, ribs, and vertebrae. The large meat bearing bones are missing. The skeletal elements represent a single immature individual, as the vertebrae have not fully fused. The sample size is too small to analyse correlations of density and food utility.

Carnivores are not usually associated with human subsistence strategies. One exception is the Cape fur seal. Current interpretations attribute the presence of small carnivores in archaeological assemblages due to symbolic behaviour (cf. Parkington &Fisher 2006) or as the left over remains of obtaining pelts.

Cape fur seal (Arctocephalus pusillis)

Four elements of cape fur seal are present in the assemblage, a vertebra, a radius, and two first phalanges. The elements are from an immature individual, but not a newborn. Immature seals are most vulnerable at 9 months, during the weaning period. As seals are born in November-December (Woodburne *et al.* 1995), the weaning period is approximately August-September. Weak weanlings often die and wash up on shore where they can be scavenged.

Genet (Genetta genetta)

This species is identified by a single scapula.

Caracal (Felis caracal)

The caracal is identified by a single adult distal humerus.

Wild cat (Felis lybica)

There are 36 bones representing at least two individual wild cats. The elements consist of cranial bones, innominate, a humerus, and a scapula. The dentition of the wild cats is young as the premolars are deciduous. The innominate and humerus have multiple cut marks at the joint suggestive of disarticulation, not skinning.

Felis sp.

A deciduous fourth premolar and a maxilla without teeth could be identified only to *Felis sp.*

Bat eared fox (Vulpes chama)

There are eight cranial bones and an innominate representing at least two young bat eared foxes. The second molar is erupting in one individual and but has not yet started to erupt in the other.

Canis sp.

A single metapodial could be identified only to *Canis sp.*

Small carnivore

Nineteen ribs, teeth, and metapodials could be identified only to small carnivore. Two ribs have cut marks.

Medium carnivore

There are seven premolars and molars from at least one medium carnivore.

Cape rock elephant shrew (Elephantulus edwardii)

There is a single cranium and mandible with a complete dentition.

Hairy-footed gerbil (Gerbillurus paeba)

There is a single mandible identified to the Hairy-footed gerbil.

Namaqua rock rat (Aethomys namaquensis)

A cranium has been identified as Namaqua rock rat.

Brant's whistling rat (Parotomys brantsii)

There are eleven bones identified to Brant's whistling rat, representing two individuals. Elements consist of cranial bones, a tibia, a femur, and a humerus.

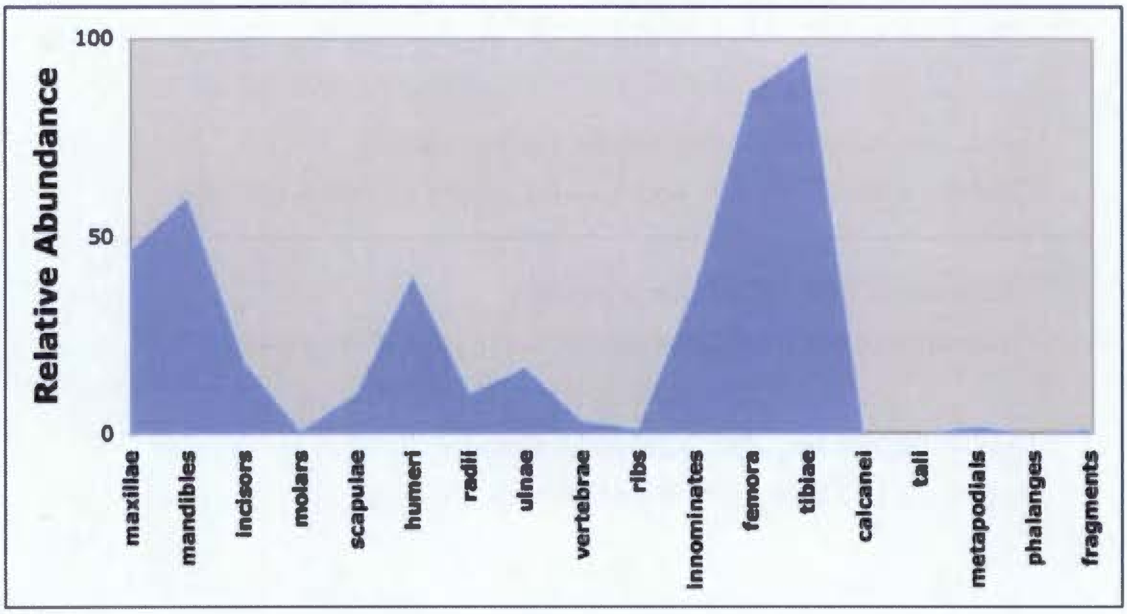
Otomys sp.

There is a molar, a mandible, and a maxilla that could be unidentified to only *Otomys sp.*

Micromammal sp.

There are 151 bones that could be identified only to micromammal sp. These consisted primarily of long bones, which are notoriously difficult to identify to species. There is a minimum of thirteen individuals based on left tibiae. The entire range of elements is present. As a large number of the microfaunal bones are not identified to species, I lumped all the micromammal bones together to analyse the relative abundance and breakage patterns. Lumping all the micromammal bones together increases the MNI to 15 based on left tibiae. The sample is dominated by hind legs (Fig. 11.14), followed by the crania and forelimbs.

Figure 11.14 **The relative abundance of the micromammal bones from LK2004-011**



Missing elements consist of the foot bones, ribs, vertebrae, and molars, all of which are small and easily lost through the sieve. Otherwise, the animals seem to be represented by whole individuals. When comparing the MNI of crania to the MNI of post-crania (Table 11.5), nearly half the crania are missing from the assemblage. However, when comparing the MNI of crania to the MNI of the robust long bones, the humeri and femora, the ratio is closer to 1 (Table 11.6). Most of the crania are heavily fragmented with only two whole crania, a Namaqua rock rat and a Cape rock elephant shrew. As crania are fragile it is expected that they would be fragmented. The presence of eleven isolated incisors and only eight empty sockets suggests that there is a minimum of one skull missing in the assemblage.

Table 11.5 **Indices of micromammals at Lk2004-011. Postcrania/crania is (femur+humerus+radius+ulna+tibiae /maxillae+ mandibles+isolated teeth). Femora+ humeri/mandibles+maxillae is a second index to identify the importance of isolated teeth on the results of the index. Tibia+radius /femur+humerus identifies the loss of distal limb elements, while %isolated molars and %isolated incisors are measures of observed isolated teeth/ observed empty alveolar spaces (Fernandez-Jalvo 1995). A measure greater than 1 suggests the destruction of jaws while less than 1 suggests missing teeth**

Index	LK2004-11
MNI Postcrania (15)/crania (9)	1.7
MNI Femur+ humerus(19)/mandible+ maxilla(16)	1.2
MNI Tibia+ radius(17) /femur+ humerus(19)	0.89
%Isolated molars (1 molar, 23 empty sockets)	0.04
%Isolated incisors (11 incisors, 8 empty sockets)	1.38

Table 11.6 **Post-cranial breakage of micromammals at LK2004-011**

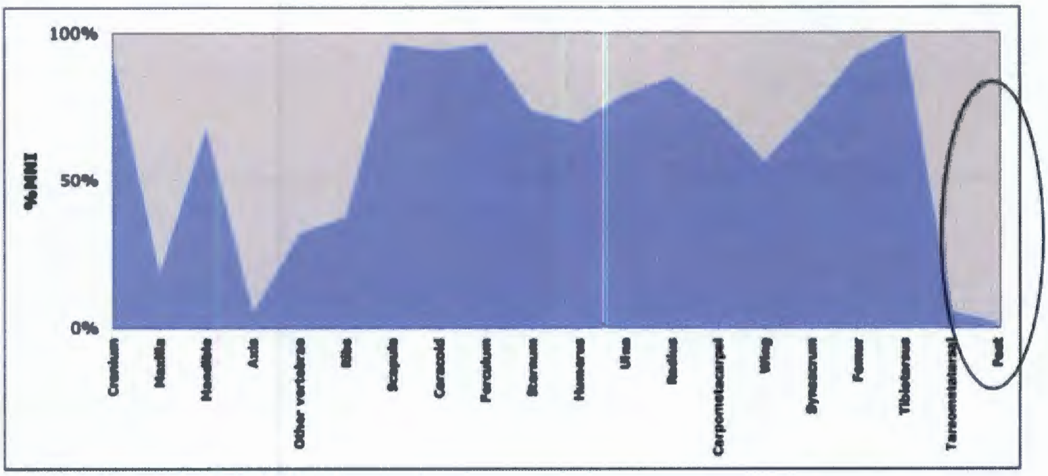
Elements	No.	%No.
Humerus		
Complete	6	55
Proximal	1	9
Shafts	0	0
Distal	4	36
Ulna		
Complete	5	100
Proximal	0	0
Distal	0	0
Femur		
Complete	13	48
Proximal	13	48
Shafts	0	0
Distal	1	4
Tibia		
Complete	15	51.7
Shafts	5	17.2
Proximal	3	10.3
Distal	6	20.7

All the ulnae are complete and at least half of the other long bones are also complete (Table 11.6). Looking at the robust upper long bones versus the lower limb bones, there are nearly as many tibiae and radii as there are humeri and femora (Table 11.6). As these values are nearly identical, preservation cannot be due to the robusticity of the bone, or density properties. The microfauna are fairly whole and only 2/151 bones have evidence of burning or human modification. When comparing the distribution of the micromammals with the total bone sample, the micromammals are more evenly distributed across the site. There are no micromammal remains in the squares with the highest concentration of total bone and there are few micromammal bones within the in-situ midden. There is also no evidence on the surface of the bones for acid etching due to digestive juices from birds of prey, carnivores, or humans (cf. Andrews 1990, Dewar & Jerardino 2007). All these lines of evidence point to the likelihood that the micromammal remains at LK2004-011 are not human food refuse, but are the remains of animals that lived in the vicinity of the site.

African penguins (Spheniscus demersus)

Of the range of bird bones present at the site only the African penguin is present in significant numbers. In total, there are 3,196 bones representing at least 53 individuals based on right tibiotarsals. This is by far the largest concentration of penguins identified in an archaeological context in South Africa. Most of the bones are fused, identifying them as adult, but there is also one old adult and thirteen juveniles at the site. Penguins have an extended breeding season, with peaks during September and February (Avery 1977). All elements are present in the assemblage suggesting the birds were brought to the site whole, and considering the close proximity of the site to the rocky bay, there was probably a breeding colony nearby, although not in anatomical abundance. Analyzing the distribution of the penguin elements, the feet, ribs and vertebrae are missing, while the crania are heavily fragmented (Fig. 11.15).

Figure 11.15. **The element distribution of African penguin from LK2004-011. Note the foot bones are missing**



The skulls are all broken at bregma, suggesting a hunting strategy of smashing in their heads. The majority of the tibiotarsals (73.6%) are burnt at the distal end and 69 of them are broken transversely. The suggests that legs were placed in the fire with the foot removed, hence only the distal 20% of the tibiotarsals are burnt from direct exposure to flame (Buikstra & Swegle 1989, Lyman 1994). The lack of foot bones in the assemblage speaks to the validity of this hypothesis. Seventy-eight penguin bones have cut marks, 15 of which are indicative of skinning the birds for pelts, while the rest are found at articular surfaces indicative of disarticulating the limbs. The evidence for skinning consists of ten humeri with cut marks near the head in the same location as those produced in a skinning experiment conducted by Avery (1985). In additional, all four tibiotarsals exhibited the same cut marks on the lateral side of the distal end that the experiment produced. Finally, there is a single cut mark on a mandible that is most likely due to the removal of the skin around the face (Avery 1985). The evidence for skinning is of particular interest as drawings from Robert Gordon's travels to Namaqualand in the 18th century, portray Khoisan men wearing capes made from penguin pelts (Fig. 16) (Cullinan 2006).

Figure 11.16 **These two drawings from Gordon's travels ca. 1743-1795 AD (Cullinan 2006), depict men wearing cloaks that may be made of penguin pelts**

Ostrich (Struthio camelus)

There are eight bones identified to ostrich, representing a minimum of two individuals. Interestingly they are all foot bones.

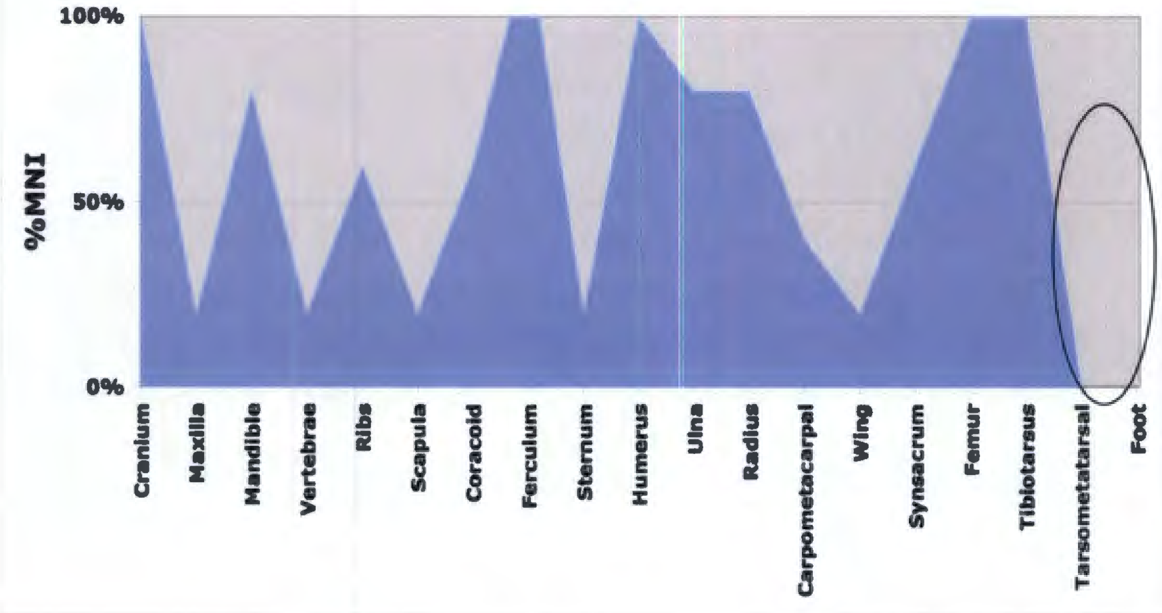
Small Aves sp.

There are 8 bones identified to small aves sp., consisting of wing bones, a sternum, a rib, and a tibiotarsal.

Medium Aves sp

There are 190 elements identified only as medium size aves the size of a Southern black koraan (*Eupodotis afra*). The majority of the bones are ribs and vertebrae, but otherwise all elements are present except the foot bones (Fig. 11.17).

Figure 11.17 The element distribution of the medium Aves from the Penguin Midden, LK2004-011. Note the foot bones are missing



Large Aves sp.

A single humerus fragment could only be identified to large Aves. The bone comes from a bird the size of a Kori bustard (*Ardeotis kori*).

Medium and large fish sp.

There are 30 bones including rays, ribs, spines, cranial bones, and vertebrae that together represent at least one medium size fish. There are also eleven vertebrae and a cranial bone from at least one large fish. The fish most likely originate from the rock pools in which the crayfish are collected. The lack of any quantity of fish, and any evidence for fishing tools, suggests that these fish were probably opportunistic catches.

Snake

There are only four snake vertebrae.

Lizard

Three bones were identified to lizard, a maxilla and two mandibles.

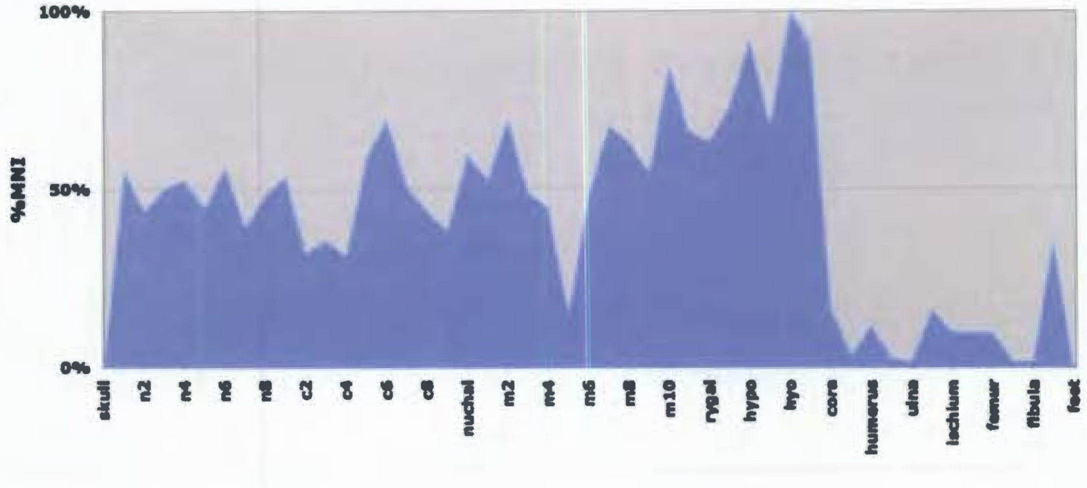
Speckled padloper (Homopus sugnatus)

There are 29 bones identified to speckled padloper, representing at least four individuals, based on the tenth marginal bone.

Angulate tortoise (Chersina angulata)

There are 6,051 angulate tortoise bones representing a minimum of 112 individuals. All elements are present, but there is a low incidence of limb bones, and no cranial or foot bones (Fig. 11.18). Male angulate tortoises have elongated epiplastrons used for fighting over females and territory, so epiplastrons can be used to easily identify the sex of the animal. Thus, there are 24 female and 14 male angulate tortoises in the assemblage. Most of the tortoise bones are similar in size and thus age, however there are three tiny individuals, three small individuals, and one very large individual. The average breadth of the distal humeri is 6.23±0.5 mm with a range of 5.3-6.7mm (n=11). The average breadth of the distal femora is 5.8±0.5mm with a range of 5.2-6.5mm (n=8). A total of 639 angulate tortoise bones are burnt: 416 are carapace fragments; 165 are plastron; and 58 are limb bones. Thus, it seems that more carapaces are exposed to flame than plastrons.

Figure 11.18 **The element distribution of angulate tortoise elements from LK2004-011. C=carapace, M=marginal, N=neural**



Bone modification

Evidence for human modifications made to the bone assemblage include cuts marks, heat alteration, and a range of breakage patterns. Cut marks were identified on 108 bones with 78 or 72.2% are penguin bones, the remaining cut bones are spread across the categories of medium bird, wild cat, gemsbok, and steenbok. Heat alteration was identified on 965 bones or 9.0% of the assemblage, indicating they were in direct contact with flames (Buikstra & Swegle 1989, Lyman 1994). The majority of the burnt bones are angulate tortoise with 639 or 66.2% and penguin with 210 burnt bones or 21.8%. The presence of percussion notches, fragmented long bones, and spiral fractures suggests that people were probably processing the long bones for marrow (Johnson 1985, Lyman 1994). The percentage of oblique spiral breaks from fresh green bone is only 2.6% of the assemblage or 279 long bones indicating the animals were freshly dead when processed for marrow (Johnson 1985, Villa & Mahieu 1991). The percentage of spiral breaks is low in this bone assemblage because it is dominated by small non-mammal species such as penguins and tortoises that do not provide bone marrow. Right-angled dry bone transverse breaks were identified on the distal end of 69 penguin tibiotarsals. These elements were also burnt suggesting that the fire dried the bone, weakening the bone in the transverse plane.

Table 11.7 Modifications identified on bone from LK2004-011

Modifications		Cut marks	Burnt	Carnivore gnawing	Spiral breaks	Irregular breaks	Transverse breaks	Weathered
Total bone (N=10,617)	No.	108	965	51	279	51	18	1,199
	%No.	1.0	9.1	0.5	2.6	0.5	0.2	11.3
Angulate tortoise (N=6,051)	Carapace		416					
	Plastron		165					
	Limbs		58					

Evidence for carnivore activity is present on 51 elements or 0.5% of the assemblage, and includes both gnawing marks and canine punctures. Finally, a total of 1,199 bones or 11.3% of the assemblage was found to be in weathering stage 1 (Behrensmeyer 1978) with bone showing longitudinal cracking. This is a high percentage of weathered bone and is most likely due to recent exposure as the low percentage of carnivore marks suggests that the assemblage was rapidly buried after abandonment.

Crayfish (Jasus lalandii)

There are 1,249 crayfish mandibles in the assemblage with an MNI of 640 based on left mandibles. The right mandibles have an average mean length of 15.6±2.9 mm with a range from 9.5-21.9 mm. The left mandibles have a mean length of 14.6±2.7 with a range of 7.9-21 mm. Converting the mandible data to carapace length following (Jerardino *et al.* 2001), the average length of the carapace based on right mandibles is 102.6±17.2mm with a range of 65.5-140.2 mm and 101.9±17.2mm with a range of 59.5-141.9 mm based on left mandibles. In comparison with other sites, these are very large crayfish indeed.

Shellfish

As the penguin midden consisted primarily of shellfish, it had to be sub-sampled. Four m^2 of shellfish was collected from particularly robust patches from across the site (squares O41, P42, P44, N46). The site is dominated by four shellfish species, *Cymbula granatina* (50.4%), *Scutellastra granularis* (31.7%), *S. argenvillei* (9.0%), and *Choromytilus meridionalis* (8.6%), although *S. barbara* and *Crepidula fornicata* were also found in the sample (Table

11.8). While all of the shellfish species are edible, *Crepidula fornicata* or slipper limpet is far too small to been intentionally sought after. The *C. fornicata* or slipper limpet most likely arrived in the assemblage as a rider on one of the other species.

The mean length of the dominant shellfish is: *C. granatina* is 49.4±11.9mm, *S. granularis* is 31.7±5.1mm, *S. argenvillei* is 59.5±23.3mm, and *C. meridionalis* is 76.4±14.9mm (Table 11.9).

Table 11.8 The shellfish species identified at LK2004-011

Species	MNI	%assemblage
Cymbula granatina	280	50.4
Scutellastra granularis	176	31.7
S. argenvillei	50	9.0
Choromytilus meridionalis	48	8.6
S. barbara	1	0.2
Crepidula fornicata	1	0.2
Total	**556**	**100**

Table 11.9 The mean length and relevant statistics for the dominant shellfish species at LK2004-011

Species	Number of measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
C. granatina	142	49.4	11.9	20.9	75.6
S. granularis	137	31.7	5.1	16.1	48.5
S. argenvillei	33	59.5	23.3	14.8	87.5
C. meridionalis	39	76.4	14.9	46	106

The presence of the *C. granatina* and *S. granularis* identified that people were exploiting the mid inter-tidal zone, while the inclusion of *S. argenvillei* in the assemblage, places the occupation near or during a spring low tide, when these low inter-tidal species are easily collected.

Kilojoules

The distribution of kilojoules at LK2004-011 is dominated by terrestrial species at 61% of the assemblage (Fig. 11.19). Gemsbok provides the most kilojoules at 19% (Table 11.10 & Fig. 11.20), followed by penguin at 18%, crayfish at 12%, and grey duiker at 12% (Fig. 11.20). The shellfish contribute 8% of the kilojoules to the diet. The diet breadth is wide with many species in the assemblage, although few species make a substantial contribution to the diet.

Figure 11.19 The ratio of terrestrial and marine kilojoules at LK2004-011

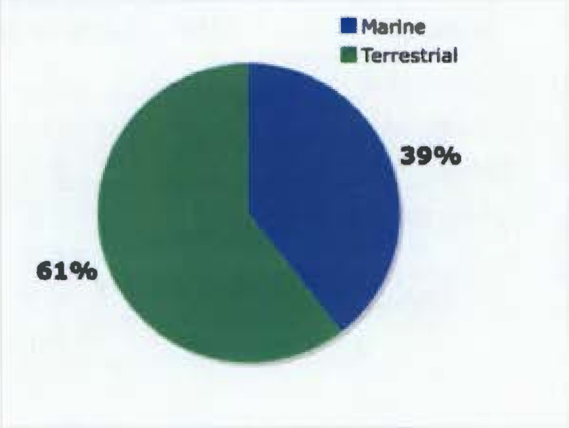


Figure 11.20 The distribution of kilojoules at LK2004-011 by species

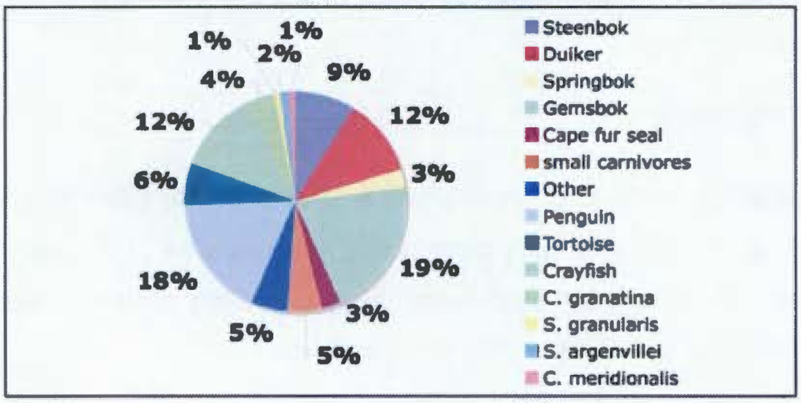


Table 11.10 The distribution of kilojoules at LK2004-011

Species	KJ/animal	Number of individuals	Total KJ
Steenbok	31,600	10	316,000
Springbok	100,300	1	100,300
Duiker	82,740	5	413,700
Gemsbok	725,700	1	725,700
Wild cat	22,040	3	66,120
Caracal	36,540	1	36,540
Genet	9,100	1	9,100
Bat eared fox	22,040	3	66,120
Cape fur seal*	99,000	1	99,000
Cape rock elephant shrew	1,000	1	1,000
Namaqua rock rat	1,000	1	1,000
Hairy footed gerbil	1,000	1	1,000
Brant's whistling rat	1,400	1	1,400
Otomys sp.	1,400	1	1,400
Micromammal sp.	1,200	7	8,400
African penguin	11,160	58	647,280
Ostrich	54,000	2	108,000
Small aves	4,000	1	4,000
Medium aves	10,000	6	60,000
Large aves	12,000	1	12,000
Medium fish	871	1	871
Large fish	1,877	1	1,877
Speckled padloper	2,000	4	8,000
Angulate tortoise	2,000	106	212,000
Lizard	1,000	2	2,000
Snake	1,000	1	1,000
Crayfish	686.7	640	439,488
C. granatina	20.6	7,227	148,886.5
S. granularis	5.4	4,543	24,532.2
S. argenvillei	42.5	1,290	54,851.6
C. meridionalis	23.1	1,239	28,620.9

*Assume the immature seal is 60% the size of an adult female

Discussion and conclusion

The penguin midden or LK2004-011 is located on a large sand dune that is located in a bay and part of a mobile dune sea. There is a single in situ midden, which is roughly dated to 1400AD. Human remains identified at the site are from a period after the occupation of the site at roughly 1273AD. The distribution of artifacts suggests two distinct areas: one on the east side of the midden that consists of refuse and one on the west side that is suggestive of a work area.

There are few formal artifacts but there is variety: three stone tools, three ostrich eggshell beads, a shaft fragment of a bone point/link shaft, and a bone bead preform. The stone tools consist of two side scrapers and a backed flake of quartz crystal. Quartz crystal is the dominant raw material, followed by a black CCS, quartzite, and an unidentified stone. The presence of debitage, cores, and hammerstones suggests that lithic processing activities occurred at the site. The bone bead preform is particularly interesting as it is the same shape as an ostrich eggshell bead, but lacks the finishing touches: no aperture and roughly hewn. The diet is rich and broad with eighteen species of vertebrates identified in the assemblage. While African penguin and the angulate tortoise are the most abundant species at the site, the single gemsbok provides more kilocalories to the diet. Other species such as the steenbok, springbok, and duiker are easily snared while tortoises are simply collected. Thus, the subsistence strategy is one focused on hunting large meat animals, supplementing the diet with a wide range of easily snared or collected species. The presence of the carnivores is most likely attributed to opportunistic exploits, or having some ritual/symbolic importance attached to them, however there is little evidence for carnivore burials (cf. Parkington & Fisher 2006) and the cut marks suggest disarticulation of the animal, not skinning.

The large number of penguins of various ages suggests that there is a colony in the near vicinity, which in conjunction with the shellfish and crayfish would provide a predictable and permanent resource making this particular area bountiful. The large number of penguins at this site is also suggestive of a specific processing site. While it is possible that collecting the meat was the primary objective of the people who created this site, the cut marks on the humeri, tibiotarsals, and mandible suggests that these animals were also being skinned. As Khoisan men in Namaqualand wore penguin pelts as capes during the 18th century when Robert Gordon passed through, it is possible that by 1400AD penguin pelts were already being sought after.

Chapter Twelve: MB2005-119

Figure 12.1 **MB2005-119 during excavation, facing west**

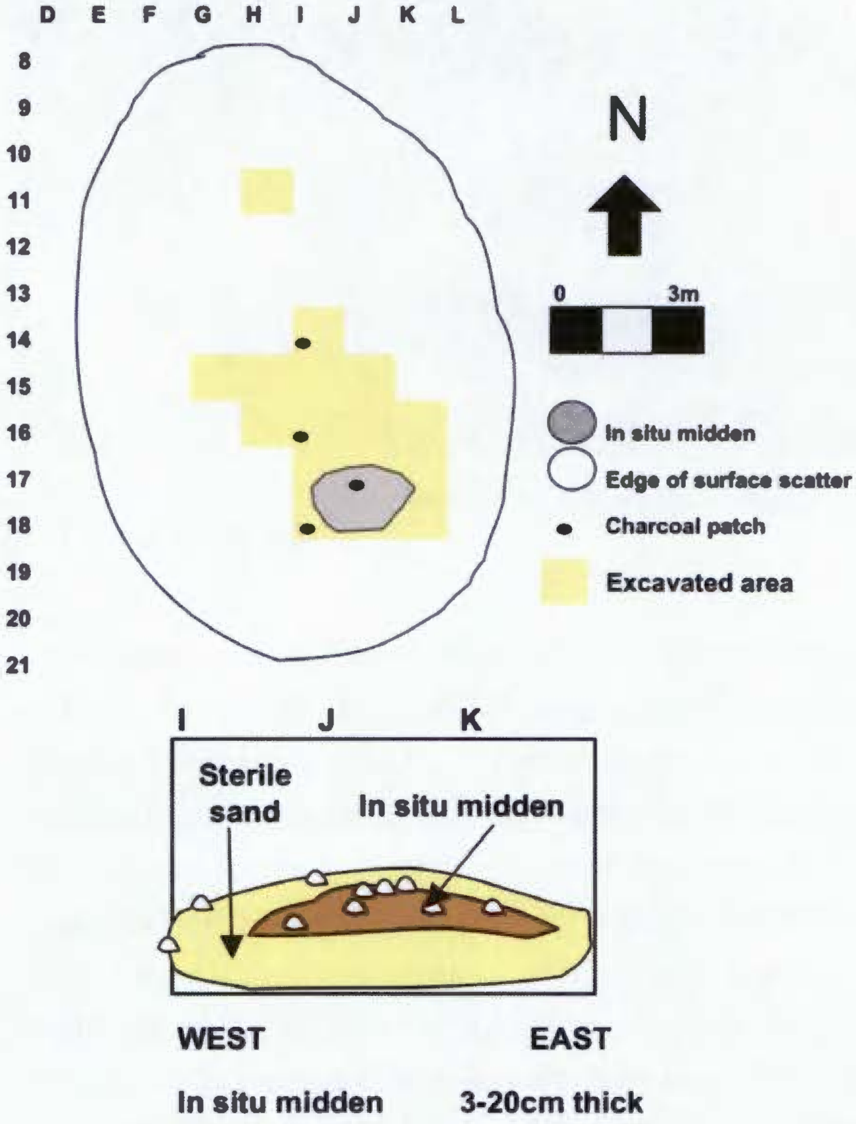
Introduction

The archaeological site MB2005-119 is a small discrete open shell midden on top of a large dune ridge in Namaqualand, South Africa (30° 27' 38.5"S 17° 21' 52.2"E) (Fig. 1.5). The dune ridge consists of older red sands but only 294m west of the site is a large north-south marine sand transport corridor consisting of white Holocene sand deposits. There are two large bays in the immediate vicinity, Mitchell's Bay one kilometre southwest and Rooiwal Bay 1.2 km northwest of the site. Both bays have sandy beaches and large rocky platforms. The perennial Spoeg River is one kilometre to the south. The Archaeology Contracts Office identified the site in 2005 during a survey of the region ahead of open cast mining at the Koignaas complex (KNC) of the DeBeers Namaqualand Mine. As the site is within a proposed mining block, it was fully excavated for analysis.

There are two patterns of archaeological site formation along this coastline. One consists of multiple patches of shell midden, while the other is single discrete shell midden, or a once off processing site (cf. Meehan 1982). This site is of the second type.

The surface consists of a 12m diameter oval scatter of deflated shell, while the in-situ midden is only 1.5m in diameter (Fig. 12.2).

Figure 12.2 **Plan and schematic profile of MB2005-119. The profile of the in situ midden is through the intersection of rows 17&18**



Excavation

A total of 16m^2 and 0.2m^3 of material was excavated using trowels and a 3mm sieve. Unfortunately, heavy rains made using the 1mm sieve impossible. The site was excavated in 1m^2 and initially excavated in two layers, surface and lower, but as the excavation continued and after analysis, it is quite clearly a single occupation unit and will be discussed as such. The maximum depth of the in situ midden is 20cm.

Features

While no hearths were identified in the excavation, there were pockets of large pieces of charcoal in the southern area (Fig 12.2) however, there is no evidence for ash. The in situ midden was completely defined and is entirely within the southern area of the site.

Radiocarbon dates

A single radiocarbon date was obtained on marine shell. The result is 850±60BP (GX-32521) with a calibrated date of 1641AD, ranging from 1492-1705AD (2 sigma).

Spatial distribution of archaeological material

The assemblage of archaeological material consists of stone, ostrich eggshell, bone, crayfish, charcoal, and shellfish, all in very low quantities. A few lithics were found in the in-situ midden, but the majority were found to have bio-turbated up towards the north end of the site (Fig. 12.3). The ostrich eggshell is highly fragmented but concentrated in and immediately north of the in situ midden, spreading towards the north end of the site (Fig. 12.4). The bone sample is primarily in the in situ midden but has also undergone some movement towards the north end of the site (Fig. 12.5). The crayfish sample is very small (three mandibles), of which one is in the midden and the others are located on the northwest side of the site (Fig. 12.6). The charcoal is also located in the midden and to the northern end of the site (Fig. 12.2). While the site is small, the shellfish was sub-sampled so the distribution of shellfish is not available. Overall, the majority of the material is located in the in situ midden, but there is evidence for a northward shifting of remains most likely due to bioturbation.

Figure 12.3 The spatial distribution of lithics at MB2005-119. Values are number of lithics per square. Blue highlights areas of dense concentration with values greater than two lithics per square

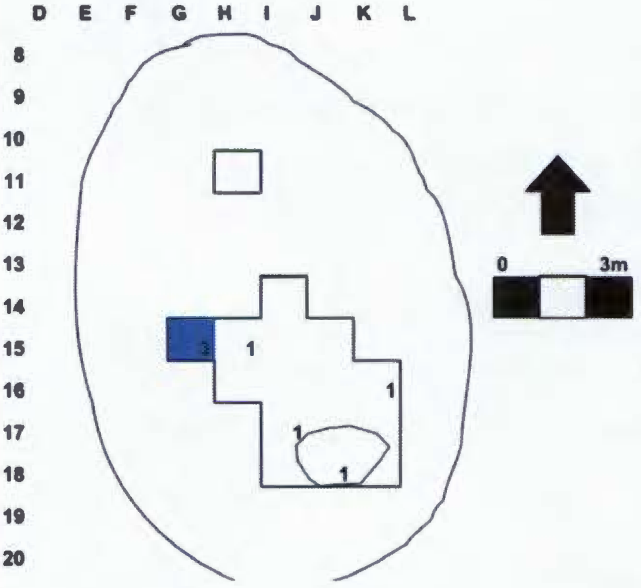


Figure 12.4 The spatial distribution of ostrich eggshell at MB2005-119. Values are numbers of fragments per square. Orange highlights the areas of dense concentration with values greater than nine fragments per square

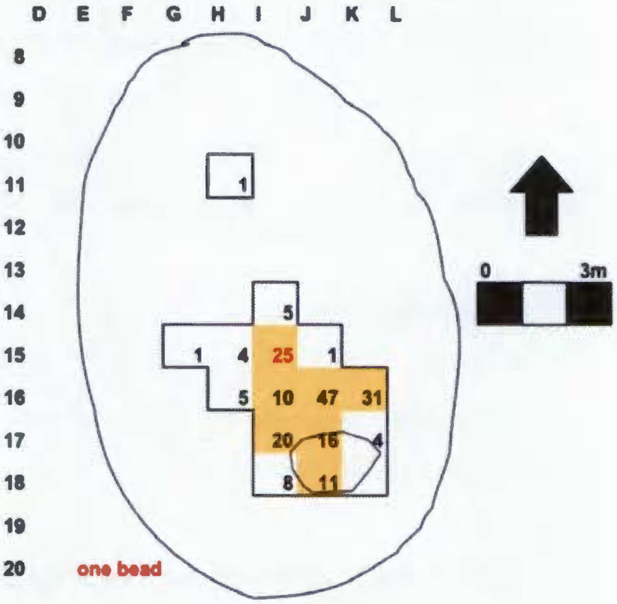


Figure 12.5 The spatial distribution of bone at MB2005-119. The values are the number of bones per square. Green highlights areas of dense concentrations with values greater than 30 bones per square

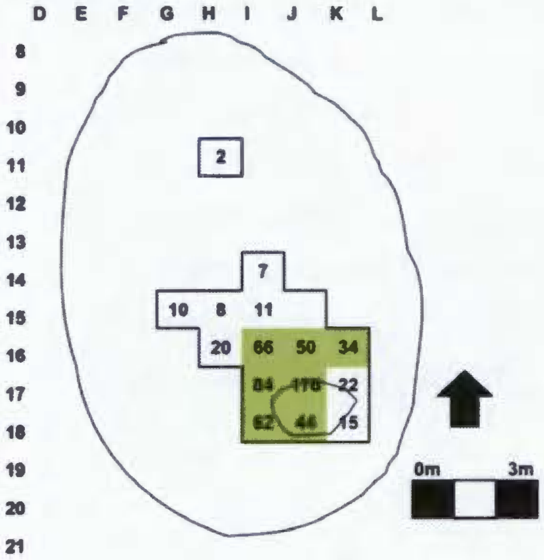
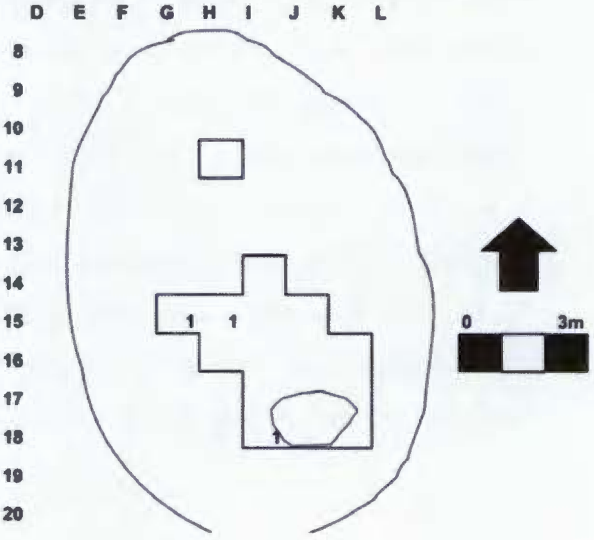


Figure 12.6 The spatial distribution of crayfish at MB2005-119. The values are numbers of crayfish mandibles per square



Lithics

Table 12.1 **Lithic raw materials at MB2005-119**

Stone	No.	%No.
Quartzite	3	42.8
CCS	2	28.6
Quartz crystal	1	14.3
Sandstone	1	14.3
Total	**7**	**100**

The stone assemblage is very small with only seven pieces in total. Three of these are quartzite, two are cryptocrystalline silicates (CCS), one quartz crystal, and one sandstone (Table 12.1). There is a single formal tool, a backed scraper made on quartz crystal with sandstone cortex. The scraper measures 15.4mm in length and 11.6 mm in width (Table 12.2). The low total number of stones makes the formal tool ratio abnormally high at 14.3% of the assemblage. The lack of any grindstones is interesting as they are quite common in the region. Perhaps this speaks to the short-term duration of the occupation of the site. The raw materials are all local, however the actual source of the quartz crystal is unknown, but as it is found more commonly in this region than other parts of the Namaqualand coast (personal observation). Also, the source of the CCS is also unclear but as there is floating calcrete underneath the sand, the source is probably local. The formal tool may in fact be an heirloom piece, especially due to the late date of this site. All other sites with backed scrapers produce radiocarbon dates that place the industry in the mid-Holocene.

Table 12.2 **The lithic assemblage at MB2005-119**

Stone	No.	%No.
Quartzite		
Flake	2	28.6
Chunk	1	14.3
Debitage sub total	**3**	**42.9**
CCS		
Flakes	2	28.6
Debitage sub total	**2**	**28.6**
Quartz crystal		
Backed scraper	1	14.3
Formal sub total	**1**	**14.3**
Sandstone		
Manuport	**1**	**14.3**

Ostrich eggshell

There are 189 pieces of ostrich eggshell in the assemblage weighing 262.1g. Many fragments of ostrich eggshell are large and with 189 fragments, there may have been multiple eggs at the site. There were no unfinished beads and only one finished bead. The finished bead has an external diameter of 8.5mm and an aperture of 3.8mm. Wear facets suggest that the bead had been worn on a string before it was deposited. The only other modification identified in the ostrich eggshell sample is erosion from wind blown sand, 41 (21.7%) of the ostrich eggshell fragments are heavily sand blasted.

Bone

Subsistence Strategy

The bone assemblage consists of 630 bones weighing 360g. In total, 337 specimens could be identified (53.3%) and the remaining sample was catalogued as unidentified fragments. The most abundant species are steenbok (*Raphicerus campestris*), followed by micromammal sp. (probably Brant's Whistling rat), and angulate tortoise (*Chersina angulata*) (Table 12.3). Other fauna identified at the site are small mammal (probably steenbok), a large and medium size snake, and a medium size bird (Table 12.3). All of the animals represented in this assemblage are small meat packages that are easily snared.

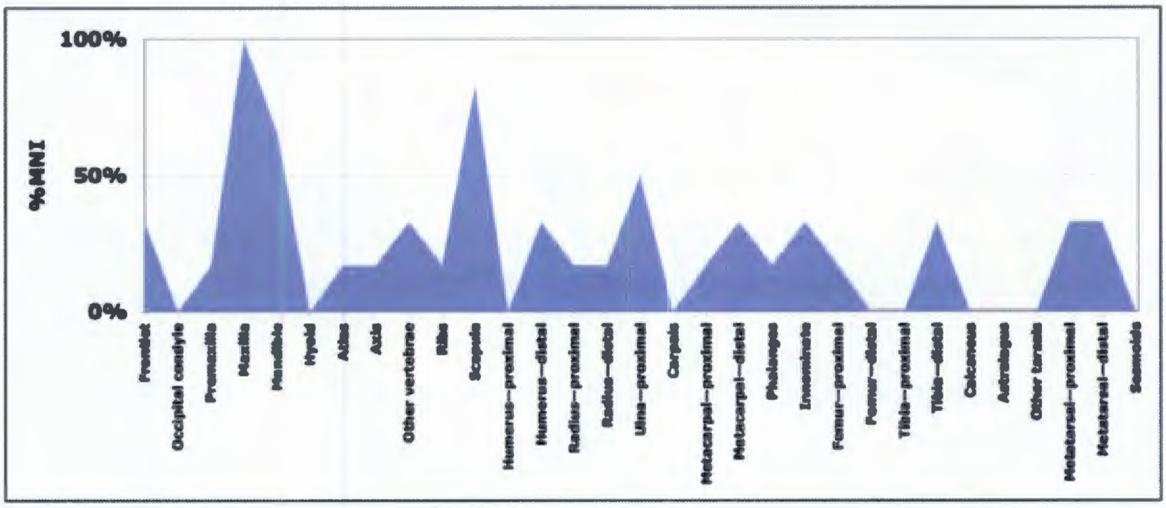
Table 12.3 **The identified vertebrate species at MB2005-119**

Taxon		NISP	MNI
Steenbok	*Raphicerus campestris*	65	6
Small mammal		147	/
Micromammal sp.		3	2
Medium bird		1	1
Medium snake		86	2
Large snake		23	1
Angulate tortoise	*Chersina angulata*	12	2
Total		**337**	**14**

Steenbok (Raphicerus campestris)

There are 65 bones identified to steenbok. Based on the ages of maxillary dentition, there are at least six individual steenbok present. There are two left maxillae with the third molar just erupting, indicating an age of 12 months (Manson 1974) and four right maxillae with a full set of adult dentition, two with light wear, and two with moderate wear. The majority of the skeletal elements are present including the low utility crania and phalanges, suggesting the animals underwent primary butchery at this site (Fig. 12.7). Some elements are not present in anatomical abundance, such as the crania, vertebrae, and ribs, while some bones are just missing such as the carpals/tarsals, hyoids, and the ends of long bones. As the assemblage is heavily fragmented, the missing elements are probably accounted for in the unidentified category or were too small to be collected in the 3mm sieve.

Figure 12.7 **The element distribution of steenbok at MB2005-119. The MNI (100%) =6**



Small mammal

A total of 147 bone fragments could be identified only as small mammal. They consist primarily of long bone shaft fragments and broken vertebrae. These are most likely from the steenbok.

Micromammal

There are three cranial bones identified to micromammal at MB2005-119. There are at least two individuals, based on left mandibles. Unfortunately, the teeth that are used for identifying species are missing. However, the bones are rat size and Brant's Whistling rats (*Parotomys brantsii*) are very common in the region. The lack of any postcranial remains may suggest that they were consumed by humans (cf. chapter 6, Dewar and Jerardino 2007), as opposed to being intrusive in the deposit.

Snakes

There is a minimum of three snakes in the assemblage: two medium snakes the size of a berg adder, and one large snake the size of a puff adder. These two species of snake are quite common in the region. While ribs and vertebrae are common at the site (n=109), there are no cranial bones. If these snakes are indeed adders, it is possible that the snakes were collected as a source of poison for arrowheads.

Tortoise (Chersina angulata)

There are twelve carapace bones, representing at least two tortoises. While both carapace and plastron elements are present, there are no cranial elements, long bones, or toe bones.

Medium Aves

There is a fragment of a left furculum from a medium sized bird, such as a Southern black koraan (*Eupodotis afra*).

Bone Modification

The most obvious modification to the bone in this assemblage is the heavy fragmentation of the long bones (Table 12.4). This is most likely due to processing the long bones for bone marrow as 125 (93.1%) of the long bones have spiral fractures (19.8% of the entire assemblage). While carnivores can also cause spiral fracturing, four bones have percussion notches, identifying human breakage of the bones (Johnson 1985, Lyman 1994). There is also evidence for a category 5 predator (Andrews 1990) as four bones have gnaw marks and 18 bones are acid etched, including two with percussion notches, which suggests that carnivores accessed the bone assemblage after humans broke open the marrow cavities (Lyman 1994). In addition, the heavily fragmented long bones could be due to carnivores splintering the bones (Morrison 1997). Considering the recent age of this site, it is possible that domestic dogs were given bones to chew on, but it is also possible that jackals arrived after the site was abandoned.

Table 12.4 Modifications identified on bone from MB2005-119. N=630

Modification	Cut marks	Burnt	Carnivore gnawing	Acid etching	Spiral break	Weathered
No.	5	4	4	26	125	31
%No.	0.8	0.6	0.6	4.1	19.8	4.9

There is little evidence for heat alteration as only one bone was slightly charred and three were calcined, but the lack of a recognisable hearth at the site suggests that fire was infrequent and ephemeral at this site.

Thirty-one bones (4.9%) showed evidence for stage 1 weathering, or longitudinal cracking parallel to the fibre surface following Behrensmeyer (1978), which indicates exposure to the sun. This in conjunction with the evidence for camivore activity suggests that the deposit was not rapidly buried after abandonment but stood open for some time.

Crayfish (Jasus lalandii)

There are only three crayfish mandibles at MB2005-119, with an MNI of two individuals. The three mandibles are too fragmented to measure and so there is no data on the size of the crayfish.

Shellfish

The shellfish was sub-sampled following the Archaeology Contracts Office protocol for 2005. Shells were retained from 6m^2 of the site in order to identify and analyse the shellfish. The shellfish assemblage contained three species of limpet: *Cymbula granatina* (85.9%), *Scutellastra granularis* (11.0%), and *S. argenvillei* (3.1%) (Table 12.5). The lengths of the shellfish were measured when possible (Table 12.6) and the mean length of *C. granatina* is 59.6±8.8mm, *S. granularis* is 37.9±5.7mm, and *S. argenvillei* is 73.5±7.0mm.

Table 12.5 **The shellfish species identified at MB2006-119**

Species	MNI	%assemblage
Cymbula granatina	804	85.9%
Scutellastra granularis	103	11.0%
S. argenvillei	29	3.1%
Total	**936**	**100**

Table 12.6 The mean length and relevant statistics of the three dominant species of shellfish at MB2005-119

Species	Number of Measurable shells	Mean length (mm)	Standard deviation (mm)	Minimum length (mm)	Maximum length (mm)
C. granatina	306	59.6	8.8	18.6	79.6
S. granularis	67	37.9	5.7	20.2	53.1
S. argenvillei	14	73.5	7.0	64.8	91.2

The dominance of *C. granatina* and *S. granularis* indicates that the mid inter-tidal zone was the focus of harvesting activities, but the mere presence of *S. argenvillei* indicates a limited exploitation of the low inter-tidal zone. This is interesting as the low inter-tidal zone is only accessible near or during spring low tides. The lack of *Choromytilus meridionalis* or black mussel is interesting as it is also available on the rocky shoreline, in greater numbers than the limpet species, and is a dominant species at most Later Stone Age sites further south.

Kilojoules

As can be seen in Fig. 12.8, two thirds of the available kilojoules at this site comes from terrestrial sources with steenbok dominating the list at 68% of the assemblage, followed by *C. granatina* at 27% (Table 12.7 & Fig. 12.9). The remaining species each contribute 1% to the total available kilojoules. In total, the shellfish contribute 29% of the kilojoules.

Figure 12.8 The distribution of marine versus terrestrial kilojoules at MB2005-119

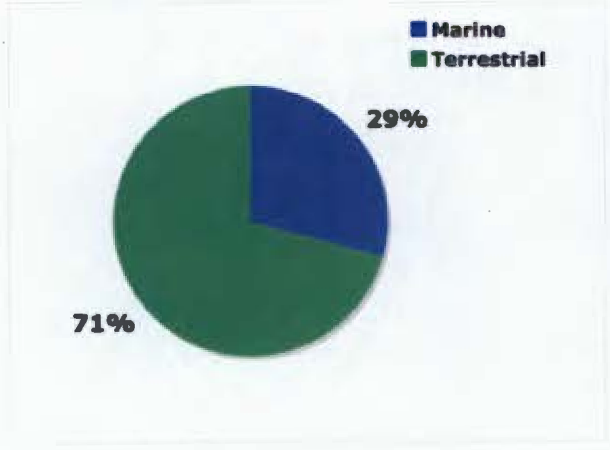


Figure 12.9 The distribution of kilojoules by species at MB2005-119

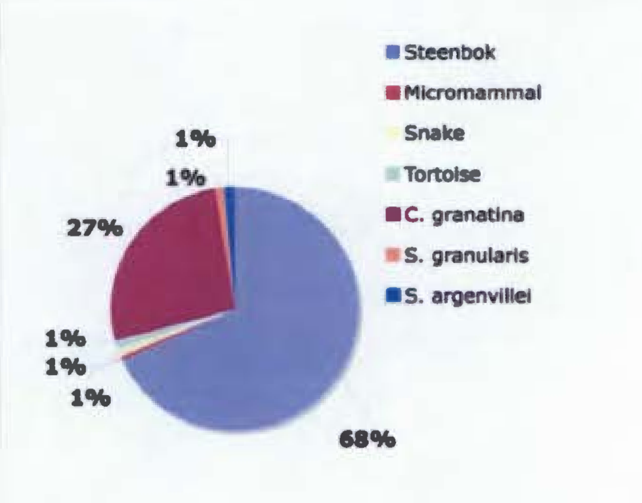


Table 12.7 Distribution of kilojoules at MB2005-119

Species	KJ/ animal	Number of animals	Total KJ
Steenbok	47,000	6	252,000
Micromammal sp.	1,400	2	2,800
Medium snake	1,000	2	2,000
Large snake	1,500	1	1,500
Tortoise	2,000	2	4,000
Medium Aves	1,000	1	1,000
C. granatina	46.2	2,144	99,052.8
S. granularis	14.5	275	3,982.7
S. argenvillei	72	77	5,544

Discussion and conclusion

The site of MB2005-119 is a small discrete shell midden located on the surface of a large dune ridge. It was occupied at roughly 1641AD. The site is roughly one kilometre distant from two large bays and the Spoeg River, providing access to large quantities of shellfish and potentially fresh water. However, there is no evidence for the exploitation of a riverine environment, such as the presence of frogs, small birds, or fresh water fish. Overall, the small diameter of the midden, the shallowness of the deposit, and the paucity of artefacts (only one ostrich eggshell bead and one formal tool) suggest that this was a short occupation, focussing on the processing of shellfish and small meat packages: steenbok, a bird, a few snakes, tortoises, and a few rodents. This is a subsistence strategy focussing on easily snared or collected species, expending little effort to obtain. The animals were returned to the site to be processed, although with the exception of the steenbok and the rodents, there is a complete lack of crania. While the skulls could have been destroyed through processing or consumption, it is probable that the snake skulls were removed from the site as a source of poison for arrowheads, ideal for hunting larger game.

The shellfish species at the site indicate a strategy exploiting the mid inter-tidal zone focussing on the largest *C. granatina* followed by *S. granularis*. This short-term occupation was most likely during or near a spring low tide as *S. argenvillei* are present in the assemblage. However, they were not the focus of the collection strategy, for while they are the largest species, they contribute fewer individuals and kilojoules than the other shellfish species. In fact, for all of the effort of collecting the *S. argenvillei* sample, the same amount of kilojoules was obtained from a single rat, bird, or snake. Perhaps what is important is the predictability of the shellfish, they are a stationary resource that requires minimal effort and they live in large groups.

It is interesting to note that crayfish is not important at this site, as they are bountiful at all other sites in this region. In addition, the lack of *Choromytilus meridionalis* or black mussels at the site is interesting as they live on the same rocky platforms as the limpets (personal observation) and they are a dominant species at Later Stone Age sites further south. One explanation is the red tides during the summer months, which make filter feeders such as the black mussel toxic. Perhaps people were avoiding the potentially toxic black mussels.

The lithic assemblage at the site is too small to identify an industry. There is a range of raw materials including both fine-grained quartz crystal and cryptocrystalline silicate and coarse-grained quartzite. The single backed scraper may in fact be an heirloom, or a pick up, since radiocarbon dates at other sites attribute the backed scraper industry to the mid-Holocene. The lack of grindstones and hammerstones suggests that lithic activities were minimal, which probably speaks to the ephemeral nature of the site.

A single large ostrich eggshell bead is the only other artefact. There is also evidence for a category 5 predator or dogs/jackals (Andrews 1990) affecting the assemblage, but they most likely arrived after the site was abandoned as the gnaw marks, punctures, and acid etching is found on bones that were first modified by humans. In addition, the weathered bones in conjunction with the carnivore evidence suggest that the site was not buried immediately after use.

Chapter Thirteen: MB2005-005-The Seal Midden

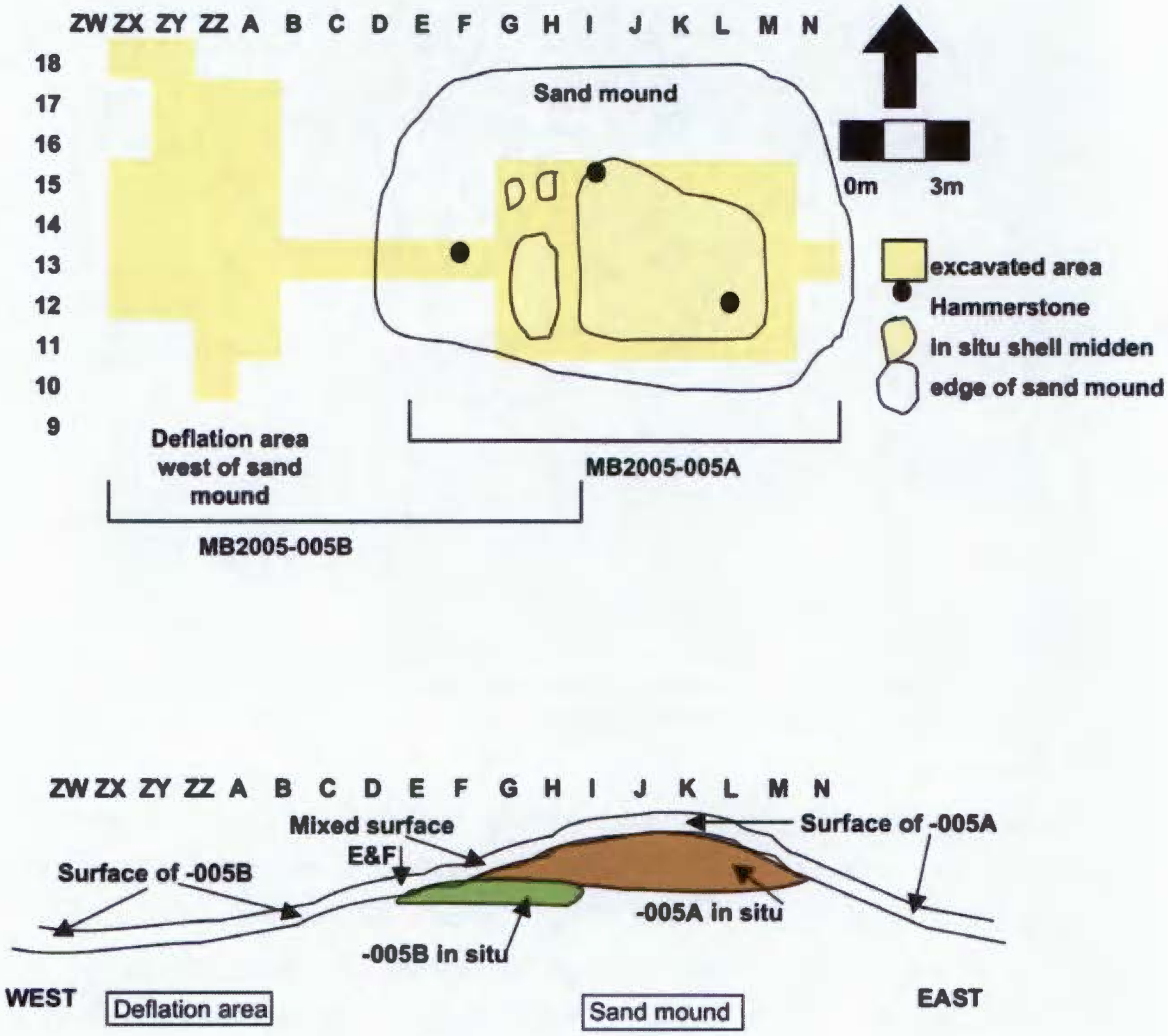
Figure 13.1 **View of MB2005-005 facing northeast during the 2005 excavation. Soft sand prevents the maintenance of neat sections.**

Introduction

The seal midden (MB2005-005) is an open-air shell midden located on the seaward side of a secondary dune ridge in Namaqualand, South Africa (30°28' 05.9" S 17°21' 36.2" E) (Fig. 1.5). The dune ridge is on the eastern arm of a sand transport corridor that sweeps northward from Mitchell's Bay. The site lies 260m due east of the Atlantic Ocean and 390m north of the mouth of the Spoeg River (Fig. 1.5). In fact, the edge of the estuary or flood zone is only 60m distant. The immediate coastline consists of a long sandy beach with rocky headlands at both ends of the bay. The mouth of the Spoeg River is usually blocked by a large sand bar, creating an estuarine environment but heavy rains can breach this barrier.

The Archaeology Contracts Office identified the Seal Midden site in 2005 during a survey of the Mitchell's Bay region for the DeBeers Namaqualand Mine. Due to the high concentration of bone visible on the surface, we returned to the site to carry out excavations in 2005 and 2006.

Figure 13.2 **Plan and generalised schematic profile of the two occupation events at the Seal Midden, MB2005-005**



Surface	5cm thick
005A	15-30cm thick
005B	16-25cm thick

Excavation

The site was excavated using standard archaeological methods and tools included a trowel, pan, buckets, a 3mm and a 1.5mm sieve. A total of $68m^2$ were excavated, yielding a total of $1.25m^3$ of shell midden. At first, the site was excavated as two entities, MB2005-005A and MB2005-005B. MB2005-005A was located on the top of a sand mound while MB2005-005B was eroding out of a deflation hollow a few meters away (Fig. 13.2). During the second field season it became clear that the two units overlapped representing two occupation layers in the same space. Thus, it is more meaningful to treat the analysis of MB2005-005A and MB2005-005B as the same site with two occupation units, with 005B representing the first occupation and 005A representing the second occupation.

Stratigraphy

The first occupation layer, 005B, is for the most part exposed, eroding out into the deflation hollow for 30m^2 (Fig. 13.2). However, there is a small (ca. 6m^2) patch of in-situ material beneath the second occupation layer. The top 5cm of the deposit consisted of disturbed material, and was removed as "surface". This was underlain by in-situ deposit, which ranged from 16-25cm thick (Fig. 13.2). Thus, a total of 36m^2 were excavated for a volume of 0.41m3.

The second occupation layer, 005A, is contained within a large sand mound beside the deflation hollow (Fig. 13.2). There are two discrete in-situ shell middens and two shell patches, from 15 to 30cm in thickness. Once again, the top 5cm was removed as "surface". The larger area of midden is approximately square, and about 5m in diameter, while the second largest is oval, about 2.5m in length. A total of 38m^2 units and 0.82m^3 of material were excavated from the second occupation with an additional 0.02m^3 of material removed from the two squares E13 and F13, which are potentially mixed assemblages.

Radiocarbon dating

Three radiocarbon dates on marine shell were obtained for the Seal Midden. The first occupation 005B returned a radiocarbon date of 5390±70BP (GX-32526), which calibrates to 3645BC with a two sigma range of 3778-3505BC.

Two dates were obtained for the second occupation. Marine shell from the base of the large midden produced a radiocarbon date of 2620±70BP (GX-32525), which calibrates to 155BC with a two sigma range from 350BC-24AD, while shell from the top of the midden yielded a radiocarbon date of 2560±60BP (GX-32524), calibrated to 69BC with a two sigma range of 212BC-71AD. The two dates from the second occupation overlap at one standard deviation, which supports the initial interpretation that this layer results from a single occupation.

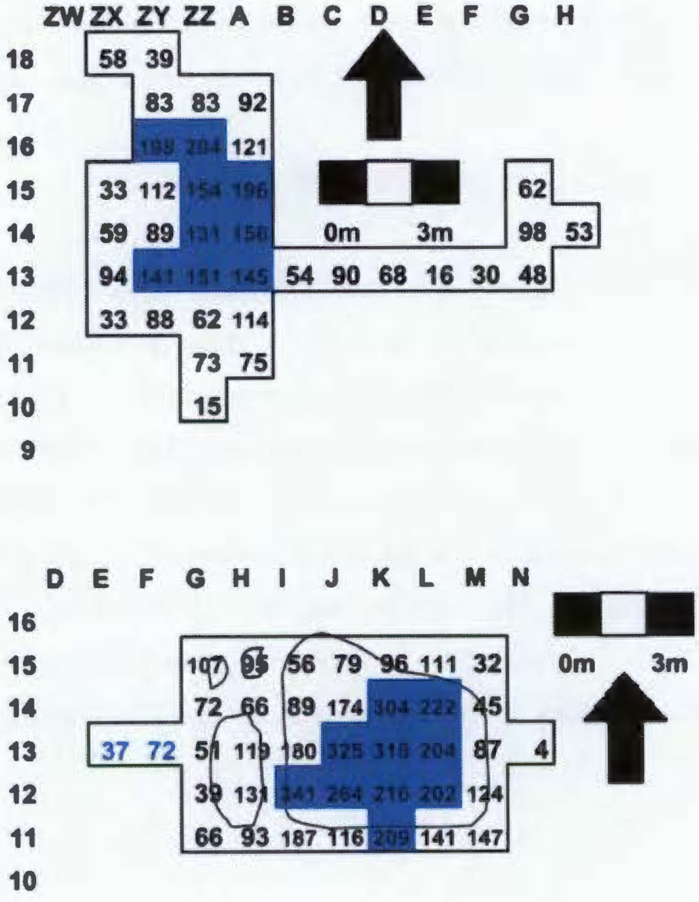
Thus, MB2005-005 was first occupied at about 3645BC, while the second occupation occurred at approximately 100BC.

Spatial distribution of archaeological material

Archaeological material identified in both occupation units include lithics, ostrich eggshell body fragments and beads, bone, crayfish, and shellfish. There is also decorated ostrich eggshell from 005B and a bone point/link shaft fragment in 005A.

The lithic artefacts are scattered across both occupation layers but within 005B the stone is concentrated in the centre of the surface scatter (Fig. 13.3). Within the second occupation 005A, the lithics are concentrated in the centre of the large midden (Figs. 13.2 & 13.3).

Figure 13.3 **The spatial distribution of lithics at the Seal midden, MB2005-005. The top map is of the first occupation B, while the bottom map is of the second occupation A. The values are number of lithics per square. The blue highlights the areas of dense concentration of material with the top map showing values higher than 130 lithics/m^2 and the bottom map showing values higher than 200 lithics/m^2. Light blue values are from the mixed surface**

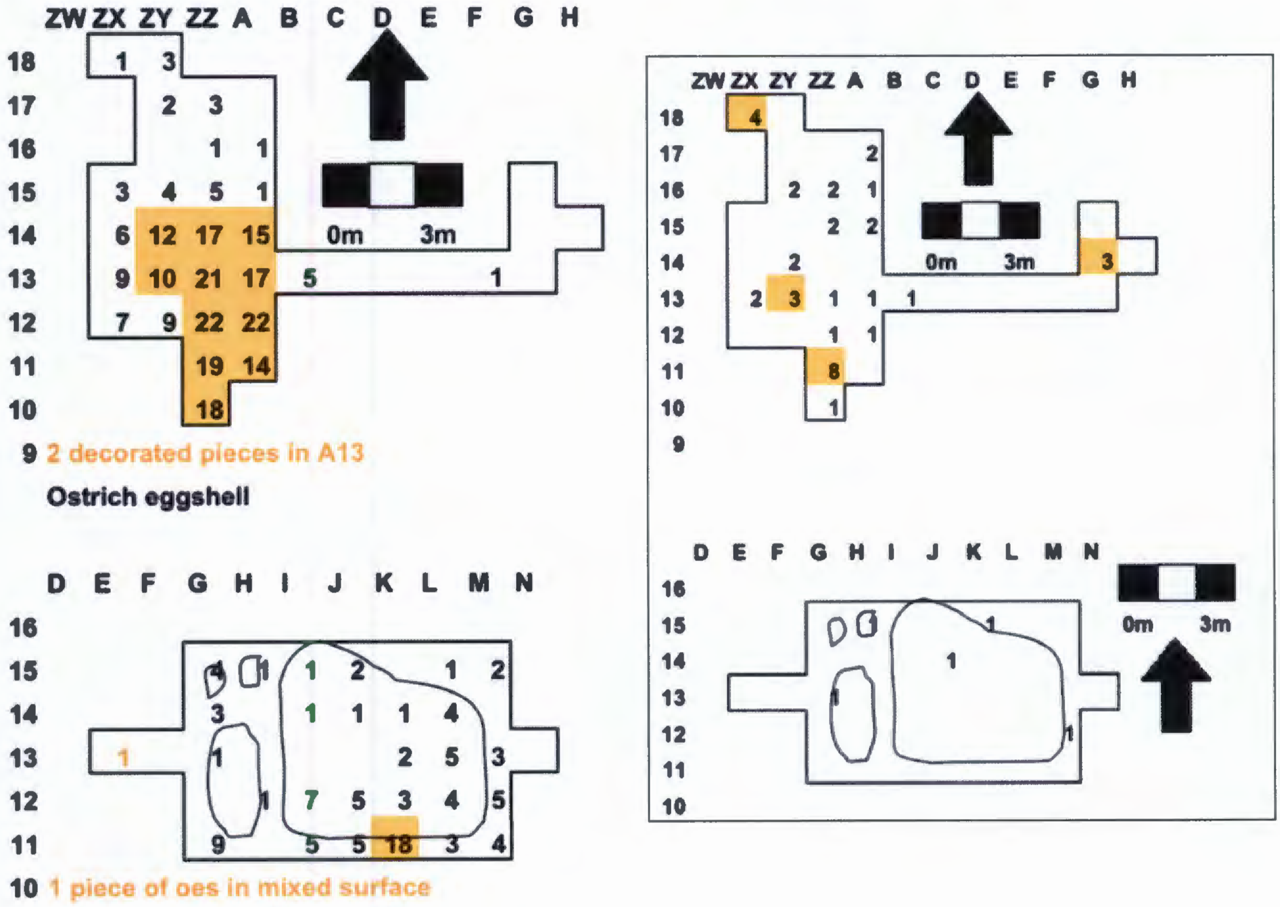


	ZW	ZX	ZY	ZZ	A	B	C	D	E	F	G	H
18		58	39									
17			83	83	92							
16			198	204	121							
15		33	112	154	196						62	
14		59	89	131	156						98	53
13		94	141	151	145	54	90	68	16	30	48	
12		33	88	62	114							
11				73	75							
10				15								
9												

	D	E	F	G	H	I	J	K	L	M	N
16											
15				107	95	56	79	96	111	32	
14				72	66	89	174	304	222	45	
13		37	72	51	119	180	325	318	204	87	4
12				39	131	341	264	216	202	124	
11				66	93	187	116	209	141	147	
10											

The spatial distribution of the ostrich eggshell is scattered throughout both occupation layers, but in layer 005B it is most densely concentrated at the south-eastern end of the surface scatter where the decorated pieces are found (Fig. 13.4).

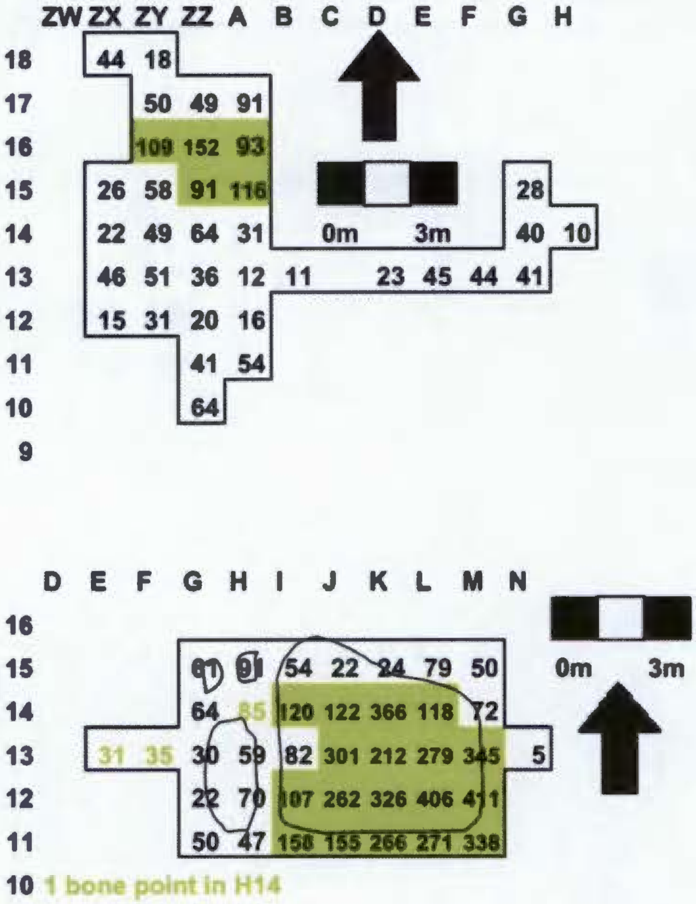
Figure 13.4 The spatial distribution of ostrich eggshell at the Seal Midden, MB2005-005. The top two figures are maps of the distribution of the ostrich eggshell fragments on the left and bead on the right from the first occupation B, while the bottom two maps show the distribution of the ostrich eggshell fragments on the left and beads on the right from the second occupation A. The values are numbers of ostrich eggshell per square. Orange highlights areas of dense concentration of material with the two left maps showing values over 10 per square and the two right maps showing values ≥ three beads per square



The beads are scattered across the site with no real pattern (Fig. 13.4). In the first occupation, there is a single square, in the south-eastern area of the surface scatter with a cluster of eight beads. The second occupation layer 005A has a single cluster of ostrich eggshell fragments in the south central area of the large midden.

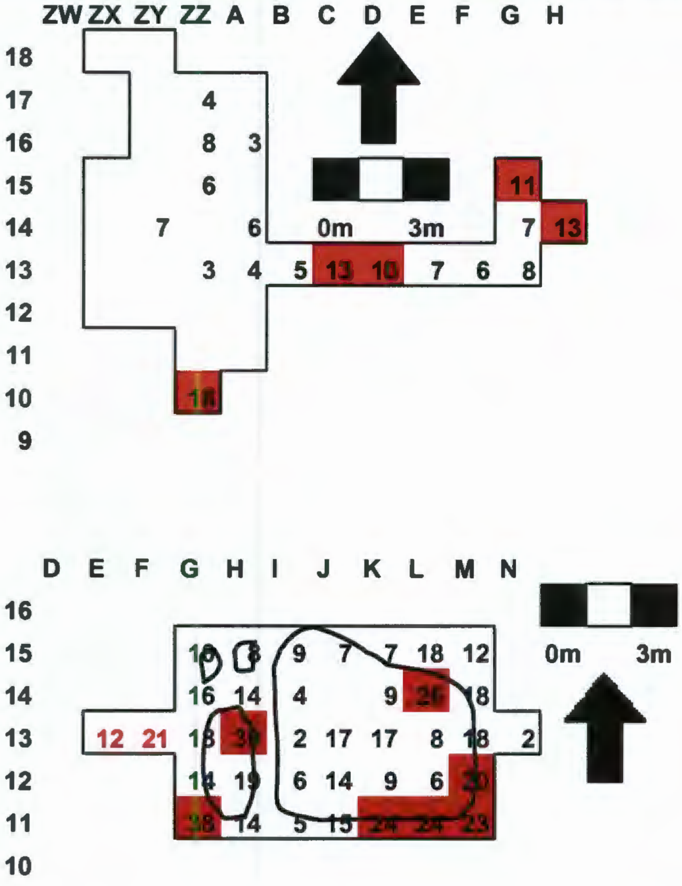
Bone is scattered across both occupation layers, but in the first occupation 005B it is concentrated in two areas: in the northern end of the surface scatter and in square G14 (Fig. 13.5). The bone from the second occupation unit is concentrated in the south-eastern corner of the large midden (Fig. 13.5).

Figure 13.5 **The spatial distribution of bone at the Seal Midden, MB2005-005. The top map is the first occupation B, while the bottom map is the second occupation A. The values are number of bones per square. Green highlights areas of dense concentration with values greater than 90 bones/m^2. Light green numbers reflect the values from the mixed surface**



The distribution of crayfish mandibles is patchy (Fig. 13.6), with three clusters in the first occupation layer: one in the in situ midden, one at the southern end of the surface scatter, and one at the eastern edge of the surface scatter. In the second occupation layer, there are four clusters of crayfish: one in the southeast corner of the large midden, one at the north-eastern end of the large midden, and two in the small midden (Fig. 13.6). Unfortunately the shellfish assemblage was sub-sampled and so data on spatial distribution are not available.

Figure 13.6 **The spatial distribution of crayfish mandibles at the Seal Midden, MB2005-005. The top left map shows the distribution at the first occupation B, while the bottom right map shows the distribution at the second occupation A. The values are number of mandibles per square. Red highlights areas of dense concentrations of material with the top map highlighting values over 10 per square and the bottom map highlighting values over 20/m^2. Red numbers are the values from the mixed surface**



There is no clear indication of activity areas, although in the first occupation layer, there is a tendency for the dense concentrations of lithics and bone to lie to the north, while ostrich eggshell lies to the south. In the second occupation layer, finds tend to be densest in the south-eastern corner of the large midden, but otherwise there is nothing to suggest specific activity zones.

Lithics

The stone assemblage (identified by Jayson Orton) is dominated by quartz crystal (Table 13.1) in both occupation layers. There are 112 lithic fragments from the surfaces of squares E13 and F13, likely to derive from a mixture of the two occupations. This small sample will not be discussed further. Of the raw materials identified at this site, quartzite and silcrete are local. Quartz crystal and cryptocrystalline silicates (CCS) may be local, as quartz crystal is the dominant lithic raw material in this entire region (personal observation) and there are floating beds of calcrete beneath the sand, possible sources of CCS.

Table 13.1 Lithic raw materials at the Seal Midden, MB2005-005

Stone	-005A		Mixed		-005B	
	No.	%No.	No.	%No.	No.	%No.
Quartz crystal	5040	98.4	102	91.2	2741	86.7
CCS	36	0.7	5	4.5	369	11.7
Specularite?	22	0.4	2	1.8	4	0.1
Other	19	0.4	1	0.9	3	0.09
White quartzite	4	0.08	2	1.8	42	1.3
Granular quartzite	2	0.04	0	0	0	0
Silcrete	0	0	0	0	1	0.03
Total	**5123**		**112**		**3160**	

005B

In the first occupation layer there are 3,160 lithic artefacts dominated by quartz crystal at 86.7% of the assemblage, followed by cryptocrystalline silicate (CCS) at 11.7% (Table 13.1). These two materials plus a single silcrete flake account for all the fine-grained materials (Table 13.2). Other raw materials include white quartzite, granular quartzite, an igneous rock, as well as a black sparkly pigment that may be specularite or some other form of mica schist (Table 13.3). The CCS is patinated, indicating that it has been exposed to the elements for a long period. Forty-eight formal tools comprise 1.5% of the assemblage: 20 made on quartz crystal and 28 on CCS (Table 13.2 & Fig. 13.7).

Table 13.2 **The fine-grained material lithic assemblage at the Seal Midden, MB2005-005**

Stone	**-005A**		**Mixed**		**-005B**	
Quartz crystal	**No.**	**%No.**	**No.**	**%No.**	**No.**	**%No.**
Sidescraper	10	0.2			1	0.03
Backed scraper	4	0.08			1	0.03
Segment					11	0.3
Backed blade	7	0.1			4	0.1
Backed bladelet	5	0.09			1	0.03
Backed flake	1	0.02			1	0.03
Backed point	9	0.2			1	0.03
Borer/drill	1	0.02				
Miscellaneous backed piece	1	0.02				
Miscellaneous retouched piece	6	0.1				
Formals sub-total	**44**	**0.9**			**20**	**0.6**
Edge damaged flake	9	0.2	1	0.9	4	0.1
Edge damaged chunk	2	0.04				
Edge damaged bipolar core	1	0.02				
Edge damaged sub total	**12**	**0.2**	**1**	**0.9**	**4**	**0.1**
Blade	7	0.1			2	0.06
Bladelet	25	0.5			28	0.9
Flake	747	14.6	12	10.7	663	20.9
Chunk	348	6.8	5	4.5	335	10.6
Chip	3776	73.7	82	73.2	1663	52.6
Debitage sub total	**4903**	**95.7**	**99**	**88.4**	**2691**	**85.2**
Bipolar core	45	0.9	1	0.9	9	0.3
Irregular core	16	0.3	1	0.9	14	0.4
Single platform core	13	0.3			3	0.1
Single platform bladelet core	2	0.04				
Radial core	1	0.02				
Cores sub total	**77**	**5.4**	**2**	**1.8**	**26**	**0.8**
Manuport	**4**	**0.08**				
CCS						
Sidescraper	1	0.02	1	0.9	11	0.3
Thumbnail scraper	1	0.02				
Backed scraper	1	0.02			6	0.2
Boat shaped scraper					3	0.1
Segment	1	0.02			4	0.1
Backed bladelet			1	0.9		
Backed point	1	0.02			1	0.03
Miscellaneous backed piece					1	0.03
Miscellaneous retouched piece	1	0.02			2	0.06
Formals sub total	**6**	**0.3**	**2**	**1.8**	**28**	**0.9**
Edge damaged flake					7	0.2
Edge damaged chunk					1	0.03
Edge damaged sub total					**8**	**0.3**
Bladelet	2	0.04			12	0.4
Flake	9	0.2	2	1.8	117	3.7
Chunk	3	0.06			61	1.9
Chip	16	0.3	1	0.9	121	3.8
Debitage sub total	**30**	**0.6**	**3**	**2.7**	**311**	**9.8**
Bipolar core					17	0.5
Irregular core					4	0.1
Single platform core					1	0.03
Cores sub total					**22**	**0.7**
Silcrete						
Flake					1	0.03

Figure 13.7 **Selected lithic artefacts from MB2005-05B. Top row from left to right: quartz crystal backed blade, backed point, and segment. Bottom row from left to right: CCS backed scraper, boat-shaped scraper, sidescraper**

The quartz crystal formal tools include a sidescraper, a backed scraper, eleven segments, four backed blades, a backed bladelet, a backed flake, and a backed point. Thus, there are more backed tools than scrapers in quartz crystal. The formal tools made on CCS include eleven sidescrapers, six backed scrapers, three boat shaped scrapers, four segments, a backed point, a miscellaneous backed piece and a miscellaneous retouched piece. Thus, there are more scrapers than backed tools made on CCS. Debitage accounts for 95.0% of the assemblage and includes bladelets, flakes, chunks, and chips from both fine-grained materials, and blades of quartz crystal. In addition, there are a few flakes, chunks, and chips of white quartzite (Table 13.3). There are 12 edge-damaged flakes, chunks and cores that account for 0.4% of the assemblage. Cores account for 1.5% of the assemblage (n=48) with bipolar, single platform, and irregular cores in both fine-grained raw materials. Apart from the four pieces of pigment (specularite?) there is a single igneous rock manuport.

Table 13.3 **The coarse-grained material lithic assemblage at the Seal Midden, MB2005-005**

Stone	-005A		Mixed		-005B	
Other	No.	%No.	No.	%No.	No.	%No.
Flake	4	0.08			1	0.03
Debitage sub total	**4**	**0.08**			**1**	**0.03**
Edge damaged flake					1	0.03
Edge damaged sub total					**1**	**0.03**
Bipolar core	1	0.02				
Core sub total	**1**	**0.02**				
Hammerstone/anvil			1	0.9		
Hammerstone/anvil sub total			**1**	**0.9**		
Manuport	**14**	**0.3**			**1**	**0.03**
White quartzite						
Flake	2	0.04	1	0.9	21	0.7
Chunk	1	0.02	1	0.9	18	0.6
Chip					3	0.1
Debitage sub total	**3**	**0.06**	**2**	**1.8**	**42**	**1.3**
Bipolar core	1	0.02				
Core sub total	**1**	**0.02**				
Granular quartzite						
Hammerstone	1	0.02				
Hammerstone/upper grindstone	1	0.02				
Hammerstone/ grindstone sub total	**1**	**0.02**				
Pigment/specularite?						
Nodules	22	0.4	2	1.8	4	0.1

005A

In the second occupation layer there are 5,123 artefacts dominated by quartz crystal at 98.4%, followed by CCS at 0.7% (Table 13.1). These are the only fine-grained materials in this occupation. Other raw materials in the lithic assemblage include the igneous rock, white quartzite, granular quartzite, and pigment (specularite?). There are 48 formal tools (0.9%): 42 made on quartz crystal and six made on CCS (Table 13.2). The quartz crystal tools consist of ten sidescrapers, four backed scrapers, seven backed blades, five backed bladelets, a backed flake, nine backed points, a borer/drill, a miscellaneous backed piece, and six miscellaneous retouched pieces. There are more backed forms than scrapers. The six CCS formal tools consist of a sidescraper, a thumbnail scraper, a backed scraper, a segment, a backed point, and a miscellaneous retouched point. There are just more scraper forms on CCS than backed tools. Debitage accounts for 96.3% of the lithic assemblage consisting of bladelets, flakes, chunks, and chips of both raw materials, and blades made of quartz crystal. There are also a few flakes and chunks of igneous rock and white quartzite (Table 13.3). There are 12 edge-damaged lithics, all on quartz crystal accounting for 0.2% of the assemblage. There are 77 cores (1.5%) on quartz crystal with a wide range of core types including bipolar, irregular, single platform, single platform bladelet, and radial cores. There are also two additional bipolar cores, one on the igneous rock and one on white quartzite (Table 13.3). The remaining lithic artefacts include 22 nodules of pigment, igneous rock manuports, a hammerstone, and a hammerstone/ upper grindstone on granular quartzite.

Clearly, lithic processing activities were conducted during both occupations considering the presence of formal tools, debitage, cores, and hammerstones. In the second occupation, there is a much lower frequency of the use of CCS. There are no CCS cores and only 30 pieces of debitage, which is low compared to the first occupation with 22 cores and 311 pieces of debitage. In both assemblages, retouched artefacts made from quartz crystal were dominated by backed forms, while those made from CCS were mostly scrapers.

Ostrich eggshell

Fragments

005B

In the first occupation layer there are 248 fragments weighing 226.2g. In the assemblage four flask container mouth fragments, identified by their ground edge and an oblique angle of breakage on the interior aspect of the aperture. Eight ostrich eggshell fragments are burnt and two are wind worn. Two pieces of eggshell are decorated (Fig. 13.8), one a fragment of a flask mouth. This is adorned with a pair of parallel lines with diagonal lines between them (Fig. 13.8). The decoration on the second piece is not as well preserved but seems to consist of two parallel lines that take the overall shape of a letter V. There are also small chevrons on one side of the first leg and on both sides of the lines on the second leg (Fig. 13.8). Overall, the motifs for both decorated eggshell fragments are parallel lines and chevrons.

Figure 13.8 **Decorated ostrich eggshell from the Seal Midden, MB2005-005B**

005A

The second occupation layer has 103 fragments of ostrich eggshell weighing 130.8g. There are eight flask mouth fragments. Two fragments show evidence of wind erosion and seven are burnt.

Beads

005B

There are 38 beads in the first occupation layer, of which all but two are stage 11 beads: finished and intact (Kandel & Conard 2005). The other two beads are both stage 12, broken finished beads. The mean external diameter of the complete beads is 4.2±0.6mm with a range of 2.4-5.5mm (Figs. 13.8 & 13.9). The mean aperture is 1.9±0.3mm with a range from 1.2-2.3mm (Fig. 13.9). These are fairly small beads as the majority of them have an external diameter less than 5.0mm. There is evidence that these beads were worn as thirteen beads have wear facets, thirteen beads (6 of which also have wear facets) are no longer round, and in eleven beads the aperture is no longer in the centre. One bead is burnt. These attributes suggest that the beads were brought to the site already made and worn for some time before being deposited, rather than being manufactured at the site.

Figure 13.9 The external diameter versus the aperture diameter of the ostrich eggshell beads at the Seal Midden, MB2005-005

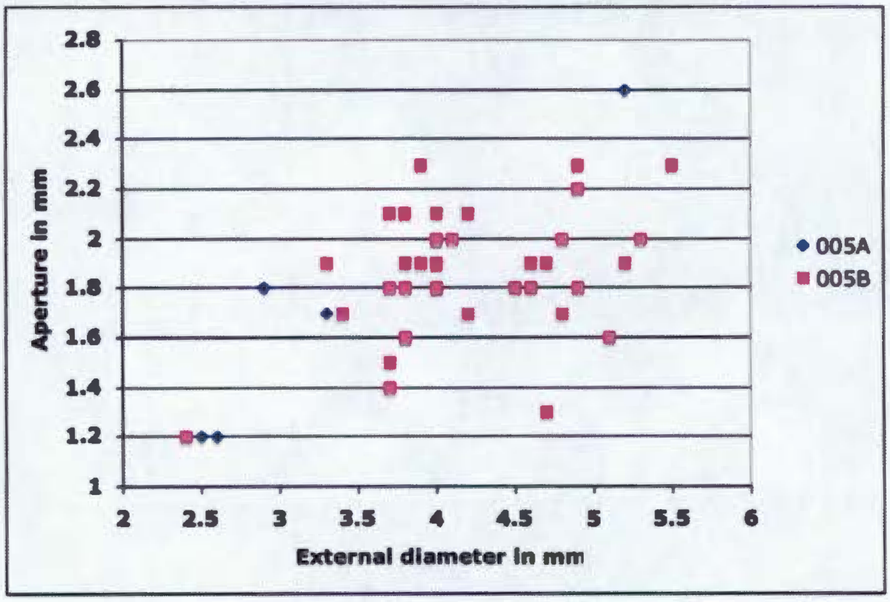
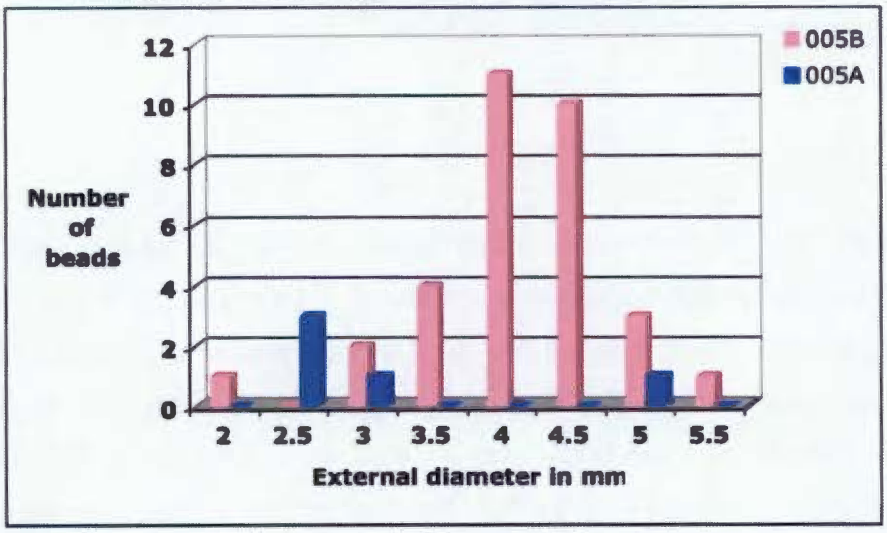


Figure 13.10 A histogram showing the distribution of external diameters of ostrich eggshell beads at the Seal Midden, MB2005-005



005A

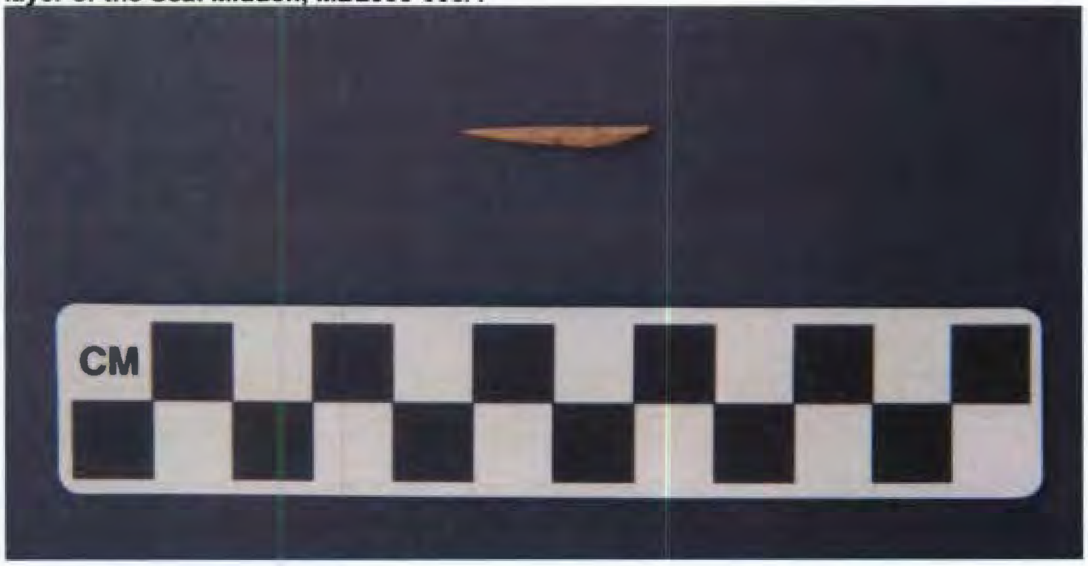
In the second occupation layer, there are five stage 11 finished beads. The mean external diameter is 3.3±1.1mm with a range of 2.5-5.2mm (Figs. 13.9 & 13.10). The mean aperture is 1.7±0.6mm with a range of 1.2-2.6mm (Fig. 13.9). This sample is, however, too small to say anything other than that the range of sizes is almost identical to that of the larger sample of beads from the first occupation. Evidence for wear is present in four beads as wear facets, although all five beads are still round with the aperture in the centre of the bead, suggesting that while the beads were worn for a long enough period to create wear facets, they were not worn long enough to start to deform the overall shape of the beads. The moderate wear of the beads suggests that they were brought to the site rather than manufactured on site.

Bone

Artefact

There is a single broken bone point/ awl tip from the second occupation layer (Fig. 13.11).

Figure 13.11 **The bone point found in the small midden in the second occupation layer of the Seal Midden, MB2005-005A**



Subsistence Strategy

005B

The faunal assemblage from the first occupation consists of 1,625 bones with 115 or 7.1% identified to lowest possible taxon (Table 13.4). The low percentage of identified bone is due to the fragmented nature of the assemblage, with the many splinters of long bone shafts. The most common taxa in the first occupation are micromammal sp. with a minimum of two individuals; all other animals are represented by at least one individual. Other species identified include steenbok (*Raphicerus campestris*), bovid size class II (BovII) and III (BovIII), Cape fur seal (*Arctocephalus pusillus*), small mammal, small-medium mammal, African penguin (*Spheniscus demersus*), angulate tortoise (*Chersina angulata*), and a medium size fish. There are at least nine different species represented in this assemblage, which is a moderate diet breadth for this region.

Table 13.4 The identified vertebrate species at the Seal Midden, MB2005-005

Taxon		**-005A**		**-005B**	
		NISP	MNI	NISP	MNI
Steenbok	*Raphicerus campestris*	130	4	1	1
Bovid size class II		4	1	10	1
Bovid size class III				30	1
Wild cat	*Felis lybica*	1	1		
Cape fur seal	*Arctocephalus pusillus*	489	5	2	1
Small carnivore		10	1		
Shrew		2	2		
Brant's whistling rat	*Parotomys brantsii*	2	1		
Rat sp.	*Otomys/Parotomys*	1	1		
Micromammal sp.		28	4	13	2
Small mammal		294	/	36	/
Small-medium mammal		19	/	6	/
Medium mammal		70	/		
African penguin	*Spheniscus demersus*	6	1	1	1
Aves		1	1		
Angulate tortoise	*Chersina angulata*	289	7	15	1
Speckled padloper	*Homopus sugnatus*	40	2		
Small fish		4	1		
Medium fish		1	1	1	1
Frog sp.		10	2		
Medium snake		70	3		
Total		**1471**	**39**	**115**	**9**

Steenbok (*Raphicerus campestris)*

There is a single metapodial identified to steenbok.

BovII (springbok Antidorcas marsupialis or grey duiker Sylvicapra grimmia)

There are 10 tooth fragments identified to BovII. These fragments most likely originated from a springbok or grey duiker, the bovid species of that size range in the region. The presence of teeth, low utility elements, suggests that the animal/s were processed at this site and only the refuse was left behind. People probably removed the high utility bones and meat to another location.

BovIII (Gemsbok Oryx gazella or red hartebeest Alcelaphus buselaphus)

There are 30 tooth fragments identified to BovIII. The teeth probably originate from a gemsbok as they are the most common size class three bovid and the only species identified in archaeological assemblages from the region, but there is a small chance that they belonged to a red hartebeest, which were present in the region historically (Skead 1980). Once more the presence of teeth and the absence of identifiable post-crania suggests primary butchery occurred in this occupation and the high utility remains were removed from the site.

Cape fur seal (Arctocephalus pusillus)

An unfused vertebral fragment and a first phalanx were identified as Cape fur seal.

Micromammal sp.

Thirteen elements were identified to micromammal sp, representing at least two individuals based on right maxillae. There is a range of elements present in the assemblage with many long bones. This pattern is more consistent with natural mortality than human consumption (cf. Chapter 6, Dewar & Jerardino 2007). However, the sample size is too small to say anything conclusive.

Small mammal

A total of 36 long bone shaft fragments were identified only to small mammal, and most likely originate from the steenbok. The high fragmentation of the long bones suggests secondary butchery activities occurred at this site, breaking long bones for access to marrow.

Small-medium mammal

A total of 6 long bone fragments could be identified only to small-medium size mammal. Again, they probably came from the steenbok or BovII and represent secondary processing of the carcass.

African penguin (Spheniscus demersus)

A distal phalanx was identified to African penguin.

Angulate tortoise (Chersina angulata)

A total of fifteen elements were identified to angulate tortoise representing a minimum of one individual. Eleven fragments could be identified only as carapace and one of these is burnt. The remaining elements consist of marginals and two plastrons.

Medium fish

There is a vertebra from a medium size fish.

Bone modification

The only modifications made to the bone are heat alteration, spiral fracturing, and weathering (Table 13.5). A large percentage of the assemblage (42.4%) is burnt; this is a high proportion in comparison to other archaeological assemblages in the region (personal observation). This is of interest, as there is no evidence of a nearby hearth. A total of 38 bones (18.5%) in the assemblage showed typical green bone spiral fracturing, indicative of secondary butchery practices. Finally, only one bone exhibited typical stage 1 weathering (Behrensmeyer 1978). Thus, the paucity of weathering damage and absence of evidence for carnivore activity suggests that the site was buried rapidly after it was abandoned.

Table 13.5 Modifications identified on bone from the Seal Midden, MB2005-005

Occupation		Cut marks	Burnt	Carnivore gnawing	Spiral	Irregular	Weathered
-005A (N=5570)	No.	53	133	15	90	1	77
	%No.	0.1%	2.4%	0.3%	1.6%	0.02%	1.4%
-005B (N=205)	No.	0	87	0	38	0	1
	%No.	0	42.4%	0	18.5%	0	0.5%

The faunal assemblage from the first occupation consists of a moderate range of available species from the region. These species are all easily snared although the inclusion of a BovIII implies some hunting activities occurred. The presence of a range of formal tools including segments that may have been used as arrowheads, supports this hypothesis. Otherwise, the subsistence strategy implied by the vertebrate species is one of hunting large game, with the addition of small meat packages that are easily collected. This assemblage also indicates heavy processing of the long bones and possible removal of the meat to another location as opposed to consumption at this site.

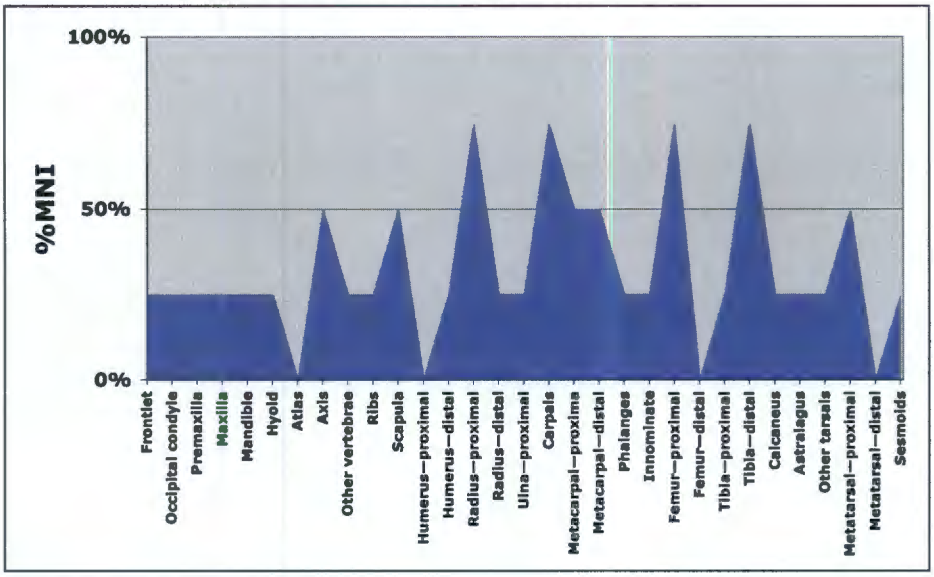
005A

The second occupation layer has a faunal assemblage consisting of 5,570 bones with 1,471 (26.5%) identified to lowest possible taxon. Once more the fragmentation of the assemblage prevented further identification of the bones. The most abundant species in this layer is angulate tortoise (*Chersina angulata*) with an MNI of 7, followed by Cape fur seal (*Arctocephalus pusillus*) with an MNI of 5 individuals, and steenbok (*Raphicerus campestris*) with an MNI of 4 individuals (Table 13.4). Other taxa identified in this occupation include BovII, wild cat (*Felis lybica*), small carnivore, a shrew, Brant's whistling rat (*Parotomys brantsii*), Otomys/Parotomys sp., micromammal sp., small mammal, small-medium mammal, medium mammal, African penguin (*Spheniscus demersus*), medium Aves, speckled padloper (*Homopus sugnatus*), small fish, medium fish, frog, and a medium snake.

Steenbok (Raphicerus campestris)

There are 130 elements identified to steenbok representing at least four individuals. The majority of bones are present in the assemblage including the sesmoids (Fig. 12), but their proportions do not match their anatomical abundance, suggesting that there has been some loss of bone.

Figure 13.12 The element distribution of steenbok at the Seal Midden, MB2005-005A. MNI (100%)=4



As the size of the steenbok sample is greater than one hundred, one can use quantitative analysis to determine which factor most likely affected the assemblage. The %MNI of the elements was compared to the bone density index (Lam *et al.* 1999, 2003, Lam & Pearson 2004) to determine if density mediated attrition was causing the bone loss. Pearson's r^2= 0.18 which is a poor correlation. In order to determine if economic strategies caused the bone loss, the %MNI of the high utility elements, bones most likely to reflect the original abundances such as long bones and mandibles (Faith & Gordon 2006), were compared to standard food utility index (Metcalf & Jones 1988). The results indicate that the steenbok bone assemblage is the result of a bulk strategy where all but the lowest utility elements are maximized (Fig. 13.13). The Shannon's evenness value E=0.9528, within the range for a bulk strategy (Binford 1978, Faith & Gordon 2006), while the Spearman's' Rho rank correlation=0.6425, P=0.0858, is also within the range for a bulk strategy (Table 13.6) (Binford 1978, Faith & Gordon 2006). Thus, the most likely explanation for the loss of bone is due to butchery and transport practices, leaving the majority of the lowest utility elements at a kill site rather than bringing the entire carcass back to the camp. The dentition indicates that there are two old adults, one with heavy wear and the other with extremely heavy wear, a yearling with the third molar just erupting (Manson 1984), and a newborn with the first molar not yet fully developed. The presence of a single horn core identifies at least one of the old adults as male.

Figure 13.13 **Scatterplot comparing the %MNI of steenbok elements from the Seal Midden, MB2005-005A with the standard food utility index. Note only the high utility bones were used**

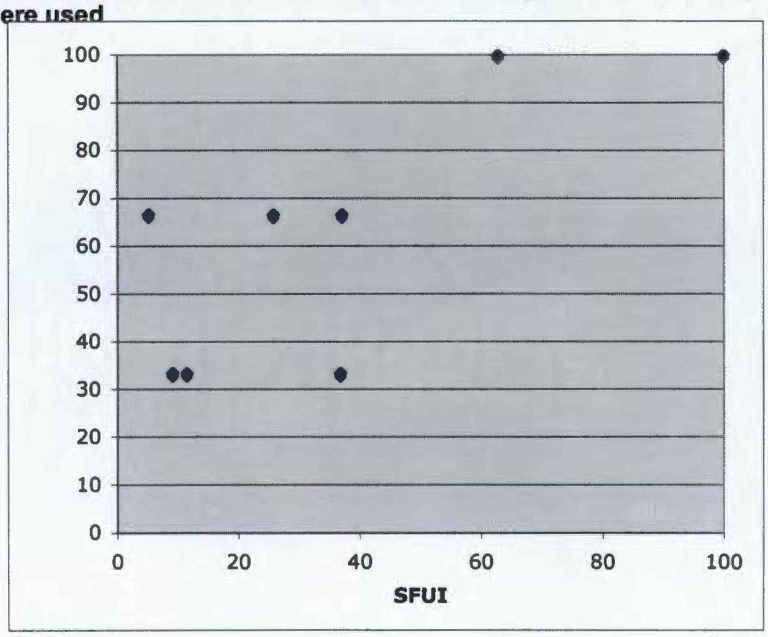


Table 13.6 **The %MNI and Standard food utility index for steenbok, and the %MNI and %MMUI and Cape fur seal from the Seal Midden, MB2005-005A**

	Steenbok		Cape fur seal	
Element	**SFUI**	**%MNI**	**%MMUI**	**%MNI**
Femur	100.0	100	13.9	100
Tibia	62.8	100	6.4	40
Metatarsal	37.0	66.6	4.8	40
Humerus	36.8	33.3	22.2	60
Radius	25.8	66.6	13.6	80
Mandible	11.5	33.3	*	*
Cranium	9.1	33.3	62.8	100
Metacarpal	5.2	66.6	7.5	40
N		130		490
Evenness		0.9528		0.611
Spearman's Rho		0.6425		0.8233
P		0.0858		0.0229
Result		Bulk strategy		Gourmet strategy

*The derivation of the %MMUI includes mandibles with crania

BovII (springbok or grey duiker)

There are four elements identified to at least one BovII individual: three vertebrae and a tooth fragment. These are low utility food items and suggest that they were left at the site as refuse from primary butchery practices.

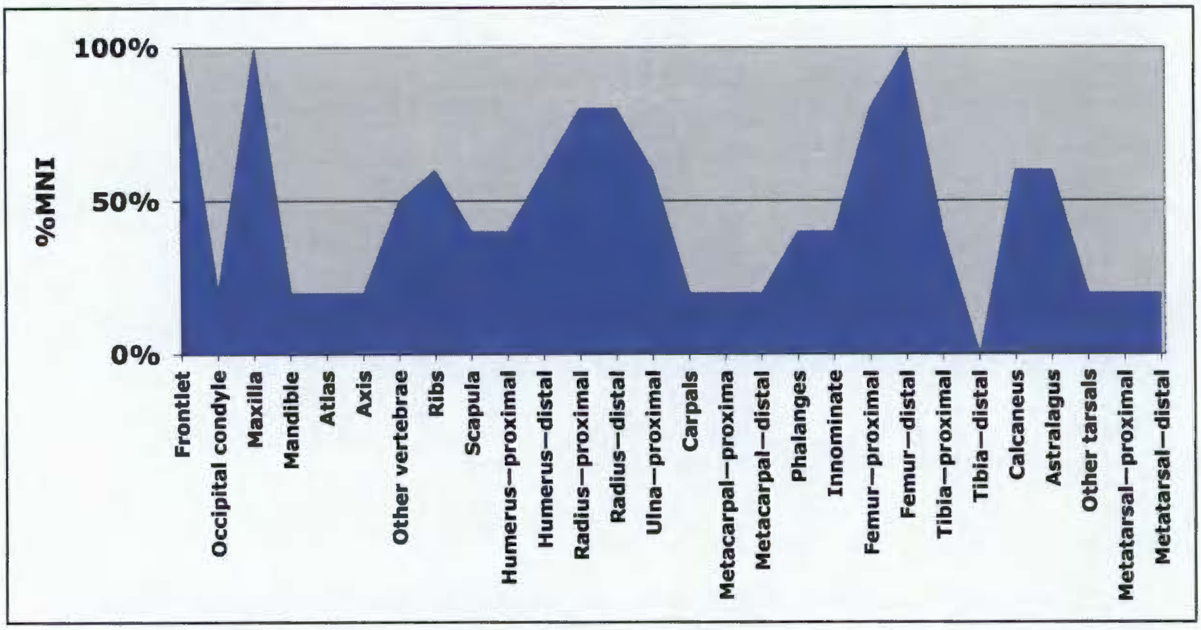
Wild cat (Felis lybica)

A single external cuneiform represents the wild cat in the second occupation layer.

Cape fur seal (Arctocephalus pusillus)

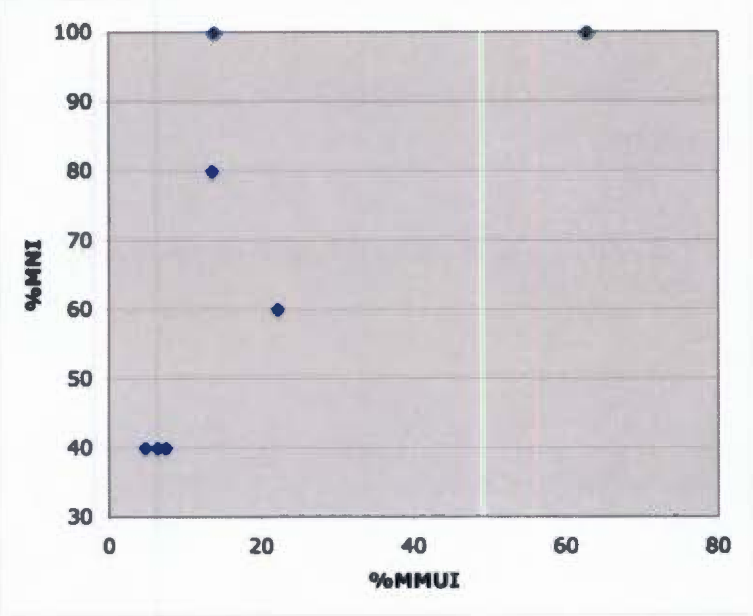
There are 489 elements identified to Cape fur seal, representing a minimum of five individuals. The majority of elements are present (Fig. 13.14) although not in anatomical abundance. Unfortunately there is no bone density index for seals but the %MNI of the high utility bones was compared to the %modified meat utility index (%MMUI) for otariids, which includes sea lions and fur seals (Savelle *et al.* 1996).

Figure 13.14 The element distribution for Cape fur seal at the Seal Midden, MB2005-005A. MNI (100%)=5



The results are consistent with the seals having been butchered and transported following a gourmet strategy, where the quality of elements transported is maximised (Fig. 13.15 & Table 13.6). Shannon's evenness value E=0.611, which is in between the range of gourmet and unbiased strategies, while Spearman's rho = 0.8233, p=0.229, within the range for a gourmet strategy (Binford 1978, Faith & Gordon 2006). Thus, the seals underwent primary butchery on site and the best quality high utility portions were removed. There are at least two newborns based on the amorphous diaphyses of the left femora, while the presence of a baculum identifies an adult male. There is also an adult female based on a set of dentition with small canines. The presence of newborns indicates that the seal rookery is a breeding colony. The presence of adult males and newborns together identifies the season of occupation as early summer, November / December. This is when males return to the colony to wait for the females to drop their pups and thus be eligible to mate again, which usually occurs within the week.

Figure 13.15 Scatterplot comparing the %MNI of Cape fur seal elements from the Seal Midden, MB2005-005A with the %MMUI. Note only high utility bones were used. The result is a typical bulk utility curve



Small carnivore

There are ten elements that could be identified only to small carnivore. The bones consist of teeth, a talus, and vertebrae. These elements most likely belong to the wild cat.

Shrew

There are two left mandibles identified to shrew species.

Brant's whistling rat (Parotomys brantsii)

There are two Brant's whistling rat incisors in the faunal assemblage, from a minimum of one individual.

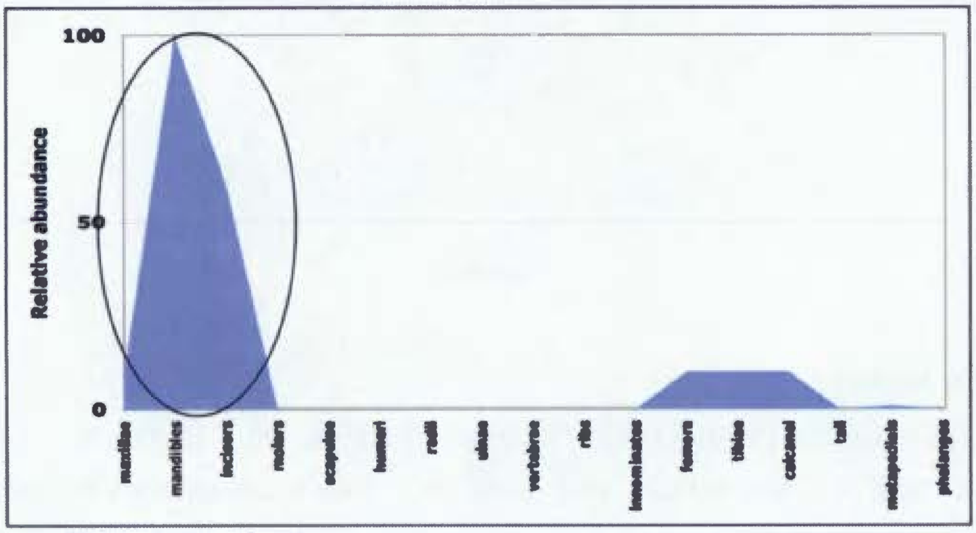
Otomys/Parotomys

There is a single third molar from a rat sized animal.

Micromammal sp.

There are 28 elements identified to micromammal, representing a minimum of four individuals. The bones include long bones, teeth, and an atlas. In order to analyse the distribution of elements, all the identified micromammal elements were lumped together and the relative abundance of the bones was plotted (Fig. 13.16). The chart clearly shows an overwhelming dominance of skull bones and a paucity of long bones. This suggests that humans were responsible for the presence of microfauna in the assemblage (cf. chapter 6, Dewar & Jerardino 2007).

Figure 13.16 **The relative abundance of the micromammals at the Seal Midden, MB2005-005A. MNI (100%)=8**



Small mammal

A total of 294 elements could be identified only to the category small mammal. The vast majority of these elements are ribs, vertebral fragments, and splinters of long bone shafts. The origin of these elements is most likely from the steenbok, but they could also be from the wild cat.

Small-medium mammal

There are 19 small-medium size mammal bone fragments. They consist of vertebrae, ribs, and long bone shaft fragments. These bones are most likely from the BovII.

Medium mammal

A total of 70 elements were identified to medium size mammal. Fifty-four of these bones are ribs, while the remaining sample consists of long bone shaft fragments and pieces of scapulae. These elements most likely belong to the BovII.

African Penguin (Spheniscus demersus)

There are six elements identified to African penguin, representing at least one individual. Elements include the proximal and distal ends of a humerus, a rib, fibula, coracoid, and a scapula.

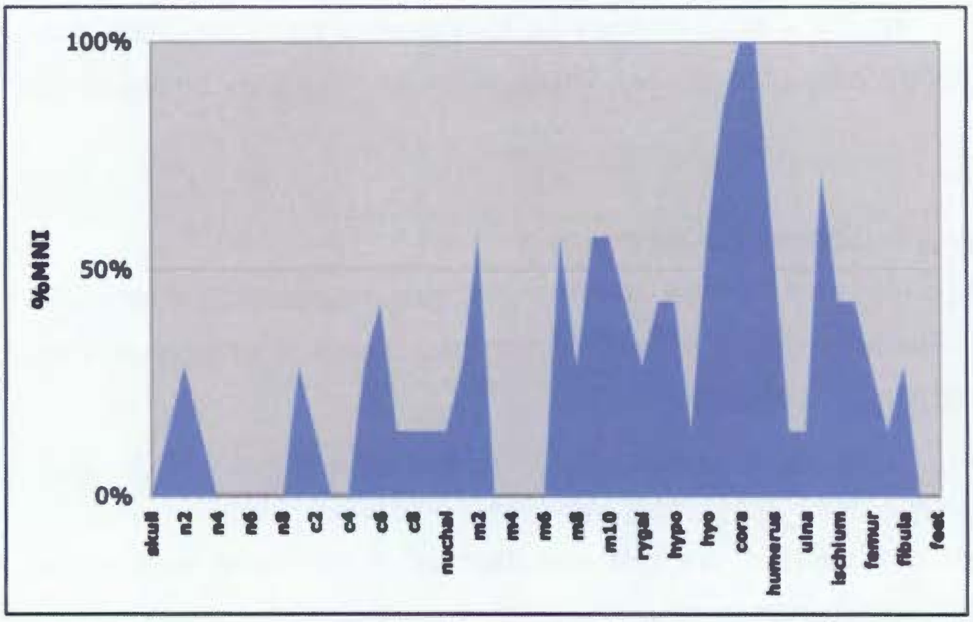
Medium aves

A pygostyle of a medium size bird was identified in the faunal assemblage from the second occupation.

Angulate tortoise (Chersina angulata)

A total of 289 elements were identified to angulate tortoise, representing a minimum of seven individuals. The distribution of elements (Fig. 13.17) shows that while many bones are present, they are not in anatomical abundance. Many of the carapace bones, the skull, and the feet are under-represented. 139 fragments of bone could, however, be identified only to carapace and another thirteen to the category marginal. This easily accounts for the missing carapace bones. Of the 57 angulate tortoise elements that are burnt, 54 are carapace, 2 are plastron, and one is a limb bone, suggesting that the animals were being placed up side down on the fire. The mean breadth of seven distal humeri is 6.0±3.0mm with a range from 5.6-6.5mm.

Figure 13.17 The element distribution of angulate tortoise at the Seal Midden, MB2005-005A. MNI (100%)=7. C=carapace, N=neural, M=marginal



Speckled padloper (Homopus sugnatus)

There are 40 elements identified to speckled padloper, a much less common tortoise in the region than the angulate tortoise. These derive from a minimum of two individuals, based on left 9th marginals. The remaining elements consist of carapace and plastron bones as well as a few long bones.

Small and medium fish

There are four small fish vertebrae and one medium size fish vertebra.

Frog

There are ten long bones identified as frog representing at least two individuals based on left humeri.

Medium snake

There are 70 elements identified to medium snake the size of a berg adder *(Bitis atropus)*. 53 are vertebrae, eleven are ribs, and six are temporal bones, representing a minimum of three individuals.

Bone modification

Evidence for bone modifications includes human, animal, and natural processes. There are cut marks on 53 elements (0.1%) primarily on seal and small mammal bones, while 133 bones (2.4%) are burnt.

Carnivore gnawing was identified on fifteen bones, while spiral fracturing is present on 90 long bones, with a single bone showing a dry transverse break. Finally, 77 bones or 1.4% of the assemblage had evidence for stage 1 weathering (Behrensmeyer 1978). The low frequency of weathering damage and carnivore modification suggests that the site was buried rapidly after it was abandoned.

The vertebrate sample from the second occupation layer identifies a subsistence strategy focussed on a broad diet with a minimum of 17 different species. All of these species are easily snared, with the exception of the Cape fur seal, which are difficult and dangerous to hunt. The presence of adult males and newborn seals in the same assemblage identifies the season of occupation of the site and the presence of a nearby breeding colony.

Crayfish (Jasus lalandii)

In the first occupation layer 005B, there are 137 crayfish mandibles with a minimum of 71 individuals based on left mandibles. The mean length of left mandibles is 12.6±3.4mm with a range of 6.8-21.3mm. The mean length of the right mandibles is 13.3±3.7mm with a range from 13.3-22mm. Following Jerardino *et al.* (2001) the derivation of the mean carapace length is 89.2±21.7mm with a range of 52.6-143.7mm based on left mandibles and 88.5±22.3mm with a range of 54.7-140.3mm based on right mandibles.

The second occupation 005A has 511 crayfish mandibles with a minimum of 256 individuals based on left mandibles. The mean length of the left mandible is 11.4±1.9mm with a range of 7.4-21.7mm. The mean length of the right mandible is 12.1± 2.4mm with a range of 6.4-26.4mm. Following Jerardino *et al.* (2001) the mean carapace length is 81.3±12.5mm with a range of 56.3-146.3mm based on left mandibles and 82.1±14.9mm with a range from 46.9-167.5mm.

Thus, it seems that the crayfish from the second occupation were smaller than the first occupation but the difference between the means is not statistically significant (t-test t=2.47, df=262, p>0.014).

Shellfish

Due to the large number of shellfish at the site, the various occupation layers were sub-sampled in order to determine the shellfish composition and mean size. The sub-sample of from the first occupation 005B consists of 3.5m^2, while the sub-sample from the second occupation 005A consists of 2m^2.

005B

The first occupation layer has a minimum of nine species in the assemblage, dominated by the local limpets and black mussel: *Scutellastra granularis* (54.7%), *Cymbula granatina* (25.4%), *S. argenvillei* (10.1%), and *Choromytilus meridionalis* (7.6%)(Table 13.7). Other species are present in minimal percentages and include whelk, *S. barbara, Crepidula fornicata, Aulacomya ater*, and *S. miniata.* Other than *S. barbara*, these species are small and most likely arrived in the assemblage as riders in the byssal threads of the *C. meridionalis* or attached to the backs of larger limpets.

The mean length of the dominant species was determined to be: *S. granularis* at 36.6±4.7mm, *C. granatina* at 58.6±10.2mm, *S. argenvillei* at 67.8±11.9mm, and *C. meridionalis* at 71.7±11.4mm (Table 13.8).

Table 13.7 **The shellfish species identified at the Seal Midden, MB2005-005**

Taxon	**-005A**		**-005B**	
	MNI	%assemblage	MNI	%assemblage
Scutellastra granularis	3,355	80.3%	868	54.7%
Cymbula granatina	665	15.9%	403	25.4%
Choromytilus meridionalis	77	1.8%	121	7.6%
S. argenvillei	27	0.6%	160	10.1
Whelk sp	48	1.1%	15	0.9%
Unidentifiable			13	0.8%
S. barbara			2	0.1%
Crepidula fornicata	4	0.09	1	0.06%
Aulacomya ater	1	0.02	1	0.06%
S. miniata			1	0.06%
Total	**4,177**		**1,585**	

Table 13.8 **The mean length and relevant statistics of the dominant shellfish species at the Seal Midden, MB2005-005**

-005A	**Number of measurable shells**	**Mean length (mm)**	**Standard deviation (mm)**	**Minimum length (mm)**	**Maximum length (mm)**
S. granularis	2,349	31.9	4.3	19	56.4
C. granatina	397	46.1	7.6	31.3	80.5
S. argenvillei	17	69.9	9.2	40.8	81.8
C. meridionalis	49	59.5	9.6	42	80
-005B					
S. granularis	279	36.6	4.7	21.2	68
C. granatina	93	58.6	10.2	34	80.4
S. argenvillei	92	67.8	11.9	23.7	90.1
C. meridionalis	64	71.7	11.4	47	105

005A

The sub sample of shellfish from the second occupation layer consists of seven different species, with limpets dominating the assemblage: *S. granularis* (80.3%) *and C. granatina* (15.9%), with relatively few *C. meridionalis* (1.8%) (Table 13.7). Other species in the sample include whelks, *S. argenvillei*, *Aulacomya ater*, and *Crepidula fornicata*. The mean length of the measurable species is: *S. granularis* at 31.9±4.3mm, *C. granatina* at 46.1±7.6mm, *C. meridionalis* at 59.5±9.6mm, and *S. argenvillei* at 69.9±9.2mm (Table 13.8).

Kilojoules

005B

In the faunal assemblage from the first occupation layer, 60% of the kilojoules come from terrestrial species (Fig. 13.17). The largest contributor is BovIII at 47%, followed by *C. granatina* supplying 12%, and Cape fur seal 11% of the total (Table 13.9 & Fig. 13.18). Overall, shellfish contribute 27% of kilojoules to the diet.

005A

In the second occupation layer, 83% of kilojoules originate from marine species (Fig. 13.18). The major contributors are Cape fur seal at 49% and *S. granularis* at 18% of the total (Table 13.9 & Fig. 13.19). Shellfish contribute 29% of all kilojoules.

Figure 13.18 The ratio of terrestrial and marine kilojoules at the Seal Midden, MB2005-005. The pie chart on the left is from the first occupation 005B, while the chart on the right is from the second occupation 005A

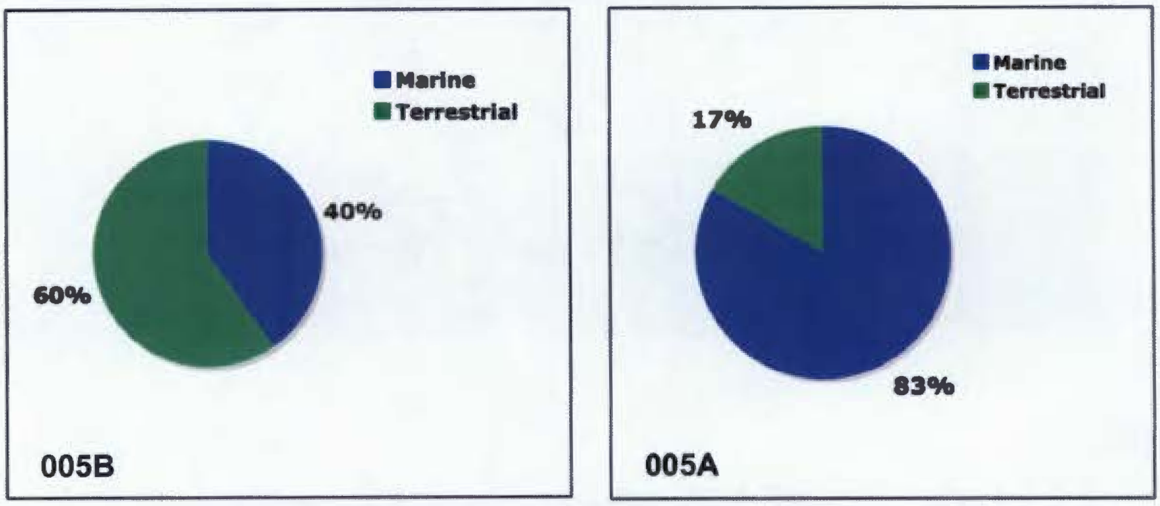


Figure 13.19 The distribution of kilojoules at the Seal Midden, MB2005-005 by species. The chart on the left is from the first occupation 005B, while the chart on the left is of the second occupation 005A

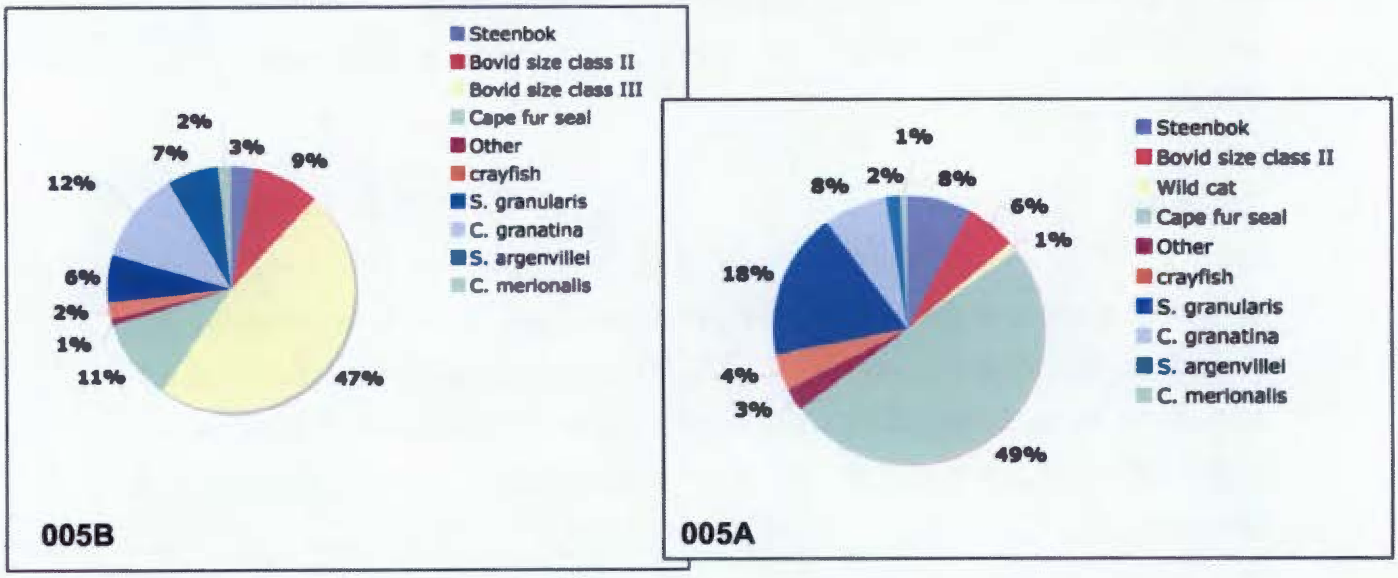


Table 13.9 The distribution of kilojoules at the Seal Midden, MB2005-005

Taxon	-005A			-005B		
	KJ/animal	Number of animals	Total KJ	KJ/animal	Number of animals	Total KJ
Steenbok adults	28,200	1	28,200	47,000	1	47,000
juvenile	47,000	3	141,000			
Bovid size class II	134,150	1	134,150	134,150	1	134,150
Bovid size class III				725,700	1	725,700
Wild cat	22,040	1	22,040			
Cape fur seal juvenile	16,500	2	33,000			
Female	165,000	2	333,000	165,000	1	165,000
Male	721,845	1	721,845			
Micromammal sp.	1,000	8	8,000	1,000	2	1,000
African penguin	11,160	2	22,320	11,160	1	11,160
Aves	9,450	1	9,450			
Angulate tortoise	2,000	7	14,000	2,000	1	2,000
Speckled padloper	2,000	2	2,000			
Small fish	1,000	1	1,000			
Medium fish	2,000	1	2,000	1,000	1	1,000
Frog	1,000	2	2,000			
Medium snake	1,000	3	3,000			
Crayfish	368.2	256	94,259.2	465.3	71	33,036.3
S. granularis	6.08	63,745	387,570	10.2	8,928	91,065.6
C. granatina	13.7	12,635	173,100	45	41,45.14	186,531
S. argenvillei	67.1	513	34,422.3	63.6	1,645.71	104,667
C. meridionalis	12.1	1,463	17,702.3	19.3	1,244.57	24,020.2

Discussion and conclusion

The Seal Midden site MB2005-005 is located between two dune ridges 260m east of the Atlantic coastline. The rocky headlands at either end of the bay were clearly important resources as they provide a habitat for shellfish and crayfish. The bay is also the mouth of the Spoeg River 390m due south, providing resources such as fresh water and riverine species. The sandy bay and rocky headlands is also a potentially good spot for a breeding seal colony.

005B

The open site was first occupied at roughly 3645BC. If the deflated material did not move far in the horizontal plane, than the site was roughly 36m^2 in size or 12m in diameter, a fairly common size for shell middens in the region (personal observation). People manufactured stone tools and processed shellfish, crayfish, and meat at the site. The most common lithic raw material was quartz crystal, with which they made backed tools of various forms especially segments. CCS was also utilised, primarily for making various types of scrapers. A black sparkly pigment was collected, probably for use as a cosmetic (Bleek & Lloyd 1911). Unlike many of the other sites described in this thesis, MB2005-05 lacks grindstones. Ostrich eggshell artefacts recovered include beads, the majority of which are less than 5mm in diameter and decorated ostrich eggshell with designs consisting of parallel lines and chevrons. The subsistence strategy is focussed on medium-large bovids, probably gemsbok, which require a high level of hunting skill to acquire and a lot of processing afterward. This terrestrial based diet is supplemented with various marine species with shellfish contributing 27% of the diet. As there is only one Cape fur seal in the assemblage, the breeding colony may not have been established yet. The presence of *S. granularis, C. granatina,* and *C. meridionalis* indicate that the mid inter-tidal zone was being exploited, but the inclusion of *S. argenvillei* suggests that the timing of the occupation was near a spring low tide, the only time that the lower inter-tidal zone can be harvested. However, the low frequency of *S. argenvillei* in the overall assemblage suggests that people were not coming to the coast specifically to obtain these largest of limpets. In total, there are nine vertebrate and ten non-vertebrate species, which makes for a fairly broad diet, even though one BovIII provided 47% of the diet. Much of the bone is burnt (42.2% of the assemblage), although no hearths were identified or charcoal recovered from the site.

005A

The second occupation of the site occurred at roughly 100BC. The site consists of two areas of in situ midden: a large one 5m in diameter and a smaller oval area 2.5m long. There are also two small shell patches. The large size of the midden identifies intense processing of shellfish as well as terrestrial animals, although it is unclear whether it took a few people a short time or many people a longer time to create such a midden. The basic activities that occurred at the site are the same as the first occupation and include the manufacture of lithics and processing of ostrich eggshell, shellfish, crayfish, and meat. The stone brought to the site is also dominated by quartz crystal at 98.4% of the assemblage, although there are a few pieces of CCS. The formal tools on quartz crystal are primarily backed, while the few pieces of CCS are primarily scrapers. For over 3,000 years people seemed to prefer quartz crystal for making backed tools and CCS for make scrapers. However, the paucity of CCS debitage or cores suggests that the tools may have been collected from the first occupation rather than being made during the second occupation. Black sparkly pigment was also collected, but the lack of grindstones, particularly lower grindstones would make it unlikely that pigment was processed on site. Ostrich eggshell beads from this occupation are very small with the majority having an external diameter of less than 3mm. These beads have wear facets, suggesting that they were worn and brought to the site already made. The only other artefact is a broken bone point/link shaft that is ground to a fine point. The subsistence strategy is focussed on Cape fur seals and shellfish, with small easily snared and collected terrestrial species supplementing the diet. Newborn seals and adult males indicate the timing of the occupation at early summer, when pups are born. The number of species exploited at this site is high with seventeen vertebrate and eight non-vertebrate species, a very wide diet breadth even though 49% of the available kilojoules came from seals. Steenbok were processed using a bulk strategy with the carcass prepared at the kill site to maximise all but the lowest utility items, whereas the Cape fur seals were killed on site, and the best meat portions were taken elsewhere. The presence of frogs in the assemblages suggests that people exploited riverine species that were not present in the first occupation.

The main differences between the two occupations are in the subsistence strategies and the sizes of the deposits. The first occupation has a subsistence strategy based on large terrestrial meat packages, while the second occupation is focussed on exploiting the seal colony and the other local marine species. The deposit resulting from the second occupation is substantially larger, indicating that the site was used for a much longer period of time or by many more people than the first occupation.

Chapter Fourteen

Stable carbon and nitrogen isotope measurements

Another method of investigating the ratio of terrestrial to marine food in the diet of past peoples is to measure the stable carbon and nitrogen isotope ratios of human bone collagen and compare them to values for the food web in that region (Katzenberg 1992, Pate 1994, Schoeninger & Moore 1992). In most environments, $\partial^{13}C$ and/or $\partial^{15}N$ values distinguish marine and terrestrial foods, and these differences are carried through into the tissues of consumers (Richards *et al.* 2003, Schoeninger *et al.* 1983, Sealy 2001, Sealy & van der Merwe 1986, Tauber 1981).

Carbon cycle

Plants that utilise the C_4 pathway (tropical grasses) fix carbon from the atmosphere into, initially, a molecule with a four-carbon skeleton. They have an average pre-industrial $\partial^{13}C$ value of -11.5‰ with a range from -6.5‰ to -14.5‰. (see caption to Table 14.1 for a definition of ∂ values). C_3 plants (bushes, trees, winter rainfall zone grasses) fix carbon from the atmosphere into molecules with three-carbon skeletons. They have an average pre-industrial $\partial^{13}C$ of -25.5‰ with a range from -20‰ to -33‰ (O'Leary 1995). The fractionation (isotopic spacing) between dietary intake and bone collagen in large mammals is roughly 5‰ for carbon. Thus, pre-industrial grazing animals that ate only C_4 grasses, should have an average bone collagen $\partial^{13}C$ value of -6‰ and pre-industrial browsing animals -21‰. There is also a third pathway called CAM (Crassulacean acid metabolism) used by desert plants such as cacti and succulents. These types of plants utilise both methods of fixing carbon and therefore have $\partial^{13}C$ values reflecting either a C_3 or a C_4 pathway, or intermediate between the two.

The marine ecosystem is based on both C_3 and C_4 photosynthesis. In studies of marine foods from the South African coast, filter-feeding shellfish have an average $\partial^{13}C$ value of ~ -16‰, while the flesh of higher trophic level seals has a $\partial^{13}C$ value of ~ -14‰ (Sealy 2006, Sealy & van der Merwe 1986). These values are very similar to those reported from other parts of the world, at similar latitudes. Although marine animals were not analysed as part of this thesis, it is safe to extrapolate carbon isotope studies of marine foods conducted elsewhere along the southern and western Cape coast to Namaqualand.

Stable carbon isotope values for bone collagen from archaeological human skeletons from the south-western Cape range from ca. -19‰ to -11‰ (Sealy & van der Merwe 1986, Sealy *et al.* 2000). The most depleted (negative) values, around -19‰, come from inland skeletons, and reflect diets based on C_3 plant and animal foods. The most enriched (positive) values, around-11‰, come from skeletons found at the coast, and indicate that these individuals relied heavily on marine foods.

Nitrogen cycle

Nitrogen fixing organisms in the ground (or the ocean) fix atmospheric N_2, which is then taken up by plants. This nitrogen is then converted into plant protein and eventually through consumption of plants into animal protein $\partial^{15}N$ values in human bone collagen reflect the nitrogen isotopic component of protein in the diet. Based on an average from many sites (n=27), terrestrial animals have a mean $\partial^{15}N$ of 5.9±2.2‰ (Schoeninger & DeNiro 1984), with herbivores averaging 4.9±1.6‰ and carnivores 8.0±1.6‰. As in the carbon cycle, fractionation of $\partial^{15}N$ occurs as one travels up the food chain, by about 3-4‰ per trophic level. On average, marine plants have higher $\partial^{15}N$ values than terrestrial plants. In addition, there are more trophic levels in the ocean so that the $\partial^{15}N$ values of high trophic level marine animals are relatively enriched: at Nelson Bay Cave on the southern Cape coast, $\partial^{15}N$ values of shellfish average 5-10‰ and seals average 16.8±1.7‰ (Sealy 2006). In temperate environments like this, $\partial^{15}N$ ratios can be used to identify marine versus terrestrial diets: people eating a marine dominated diet have higher $\partial^{15}N$ values than people eating a terrestrial dominated diet (Schoeninger *et al.* 1983, Schwarcz *et al.* 1985, Sealy *et al.* 1987). However, the local environment can have an effect on the $\partial^{15}N$ values, particularly arid terrestrial environments. Animals adapted to arid environments and exposed to water stress reduce their urinary water loss by increasing the concentration of urine in their kidneys and excreting more urea, while conserving water (Ambrose

1991, Schoeninger & DeNiro 1984). This causes an imbalance in the levels of ^{15}N since urea is depleted in the heavy isotope, while blood, milk, and faeces are enriched (Ambrose 1991). In addition, under water stress, animals tend to reduce their food intake. Any nitrogen that is not excreted in the urea is available for tissue building (Ambrose 1991). Thus, the $\partial^{15}N$ in bone collagen from animals that undergo water stress will be more positive than animals that are well watered. It is clearly important to establish the local $\partial^{15}N$ values in the local food chain in order to use isotopes to identify past human diets.

Namaqualand Isotopes

The floral kingdom of Namaqualand consists primarily of arid adapted succulents and bushes (Chapter 2), which include CAM and C_3 pathway plants. As Namaqualand is within the winter rainfall zone, one does not expect there to be many C_4 grasses, rather one expects grasses to be C_3.

In order to investigate the $\partial^{13}C$ values of the local food web, stable isotope analysis was conducted on a range of species identified from the archaeological fauna and one modern steenbok. The sample consists of two hares (grazers), five steenbok (mixed feeders), five springbok (mixed feeders), and a duiker (mixed feeder, but with a preference for browse) (Table 14.1 & Fig. 14.1).

Local food web results

The $\partial^{13}C$ values for collagen from the two grazing hares are -18.3‰ and -19.0‰. Bone collagen of animals eating purely C_3 diets is expected to be about -21‰. It appears that these hares ate mostly C_3 grasses with a small C_4 or CAM component. The mean $\partial^{13}C$ for the mixed feeders is -17.7±1.0‰ with a range from -16.4‰ to -21.6‰. These values are, on the whole, more enriched than one would expect for a pure C_3 diet. Since there are few C_4 grasses available (as shown by the relatively negative $\partial^{13}C$ values of hares), the most likely source of enrichment is the CAM succulents.

In large animals, muscle tissue is approximately 2‰ more negative than bone collagen. That means that the meat of these mixed feeders would be about -19.7‰, and the bone collagen of people whose hypothetical diet consisted entirely of such meat would be about -14.7‰. These figures are no more than very rough approximations, because uncertainties about animals and human metabolism severely handicap our ability to develop quantitative reconstructions of diet, based on stable isotope values. Nevertheless, it is important to realise that terrestrial meat foods in Namaqualand would have been significantly enriched in ^{13}C.

The nitrogen values for all the animals are high, with a mean ∂^{15}N value for archaeological bovids of 15.3±0.9‰ with a range from 13.9‰ to 17.0‰. The hares also have high ∂^{15}N values, at 13.9‰ and 14.0‰. The modern steenbok has a ∂^{15}N value (16.2‰) very similar to those of the prehistoric bovids, although it does have a slightly less enriched ∂^{13}C value at -19.9‰, suggesting that it is also an arid adapted animal that consumed less C_4 or CAM plants than its archaeological counterparts.

In comparison, the mean ∂^{15}N for terrestrial herbivores from the southern Cape coast dating from 9,000 to 500BP is 4.7±1.0‰ (Sealy 2006). In Namaqualand, the ∂^{15}N values for terrestrial herbivores are as high as those of marine animals. The most likely explanation for such high ∂^{15}N values is that these animals were subjected to water stress, enriching their ∂^{15}N values (Ambrose 1991, Sealy *et al.* 1987). This means that nitrogen isotopes cannot be used as an indicator of marine/terrestrial diets in Namaqualand. The discussion of human isotope values below will therefore focus on the information that can be obtained from carbon isotope measurements.

Table 14.1 Isotope values of animals from Namaqualand. All values for bone collagen. $\partial^{13}C_{sample}=\{[^{13}C/^{12}C_{std} \div {}^{13}C/^{12}C_{sample}]-1\} \times 1{,}000$ parts per thousand or parts per mille. The standard is PeeDee Belemnite marine limestone. Most living organisms have less ^{13}C than PDB, which means the $\partial^{13}C$ will be negative. $\partial^{15}N$ is calculated the same way as the $\partial^{13}C$, but the ratio is expressed relative to air and most living organisms have values that are more positive than air

UCT Archaeometry lab No.	$\partial^{15}N$	$\partial^{13}C$	C:N ratio (atomic)	Collagen yield	Description	Site
12769	14.7	-18.3	3.2	12.3%	Steenbok	KN6-3C
12770	17.0	-17.8	3.3	21.9%	Steenbok	LK2004-011
12771	16.2	-16.9	3.2	19.2%	Steenbok	LK2004-011
12772	14.4	-16.5	3.4	22.8%	Steenbok	MB2005-05
12773	15.8	-17.5	3.2	18.8%	Steenbok	LK2004-011
12759	16.2	-19.9	3.2	22.1%	Steenbok	Modern
12761	15.3	-18.1	3.2	27.1%	Springbok	SK400
12764	13.9	-16.5	3.2	23.9%	Springbok	SK400
12765	15.5	-18.7	3.3	23.9%	Springbok	SK400
12766	15.2	-17.2	3.4	19.7%	Springbok	SK400
12768	14.8	-17.2	3.3	19.2%	Springbok	SK400
12779	18.2	-11.0	3.3	25.7%	Duiker	DP2004-014
12767	13.9	-18.3	3.3	10.3%	Hare	KN6-3C
12777	13.9	-19.0	3.3	12.1%	Hare	LK5-1east

Human skeletal results

Stable isotope analysis was conducted on bone collagen from thirteen human burials (Table 14.2 & Fig. 14.1). Eight of the burials are from the Buffels region, ranging in age from 2208BC to 129BC: three cluster between 867BC and 816BC (Table 14.2). The other five burials are from further south: four from the Koignaas region ranging from 1743 BC to 1273AD, and one from further south at the Groen River mouth at 819BC (UCT445, Table 14.2 & Fig. 1.5): part of the same pulse of burials seen in the Buffels region. The thirteenth burial was found beneath a large sand dune at the Buffels River mouth, suggesting that it is also a Later Stone Age burial. The Koignaas region has burials from within the last 2000 years, while the Buffels region does not, but this apparent difference may simply be due to small sample size.

The mean $\partial^{13}C$ of the burials from the Buffels region is -13.4±1.0‰, ranging from -12.3‰ to -14.8‰, while the mean $\partial^{15}N$ is 15.9±1.4‰, ranging from 13.9‰ to 18.3‰ (Fig. 14.1 &Table 14.2). The $\partial^{13}C$ values indicate that some individuals (those with more negative values) ate diets dominated by terrestrial foods, while others (those with more positive values) consumed some seafood. It is noteworthy, however, that none of the skeletons have $\partial^{13}C$ values as positive as -11‰, documented along the south-western Cape coast for individuals with strongly marine-oriented diets. Consumption of ^{13}C enriched terrestrial foods, in combination with marine foods, should push values even more strongly in the positive direction. The fact that we do not see this provides strong evidence for marine foods playing only a limited role in the diet as a whole.

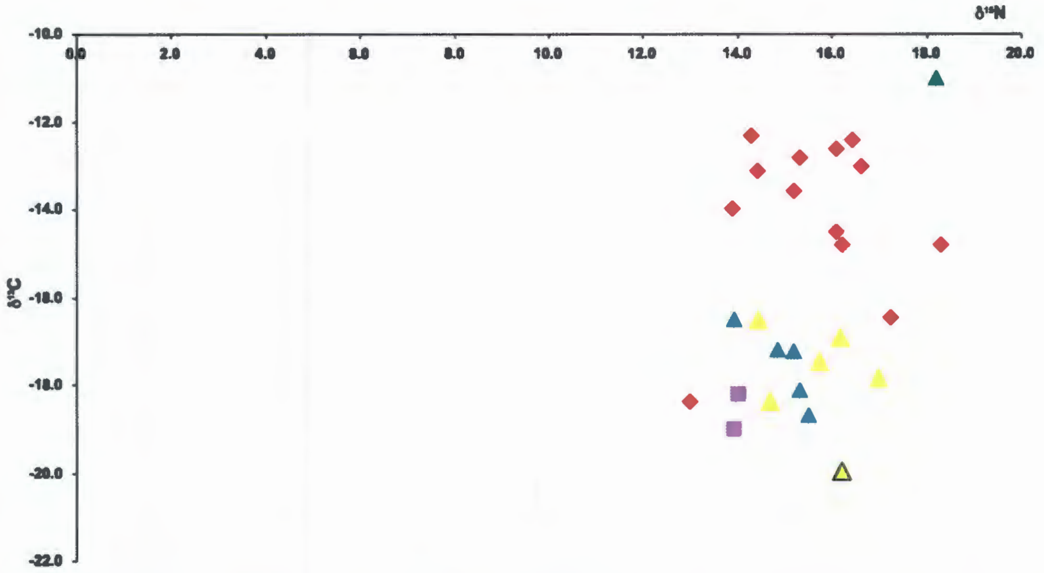
The mean $\partial^{13}C$ from the Koignaas region (plus the Groen River burial) is -15.1±2.3‰, ranging from -12.8‰ to -18.4‰, while the mean $\partial^{15}N$ is 15.2±1.6‰, ranging from 13.0‰ to 17.2‰ (Fig. 14.1 & Table 14.2). Burial Somnaas #2 is an outlier in this group with a $\partial^{13}C$ value of -18.4‰, the most depleted individual in this study, who clearly ate a terrestrial based diet. The remaining individuals have $\partial^{13}C$ values that suggest a terrestrial based diet with a limited contribution from marine food.

The $\partial^{15}N$ values are consistent with this picture. Figure 14.1 shows that $\partial^{15}N$ values for both animals and humans cluster between 14 and 16‰ (mean $\partial^{15}N$ for all animals is 15.4±1.2‰, for all humans it is 15.6±1.4‰). There is no 3-4‰ trophic level separation between the two groups. This is very likely because, in addition to meat, people were eating shellfish, which have relatively low $\partial^{15}N$ values (<10‰), because they are low in the marine food chain. Thus the nitrogen isotope values confirm that people were eating heterogeneous diets, including both marine and terrestrial foods. There is no evidence for extraordinarily positive $\partial^{15}N$ values, as would result from consumption of large quantities of high trophic level marine food such as seal meat, especially in an environment with enriched $\partial^{15}N$ in terrestrial meat.

Table 14.2 **Isotope values of bone collagen from human burials in Namaqualand. Groen River burial was published in Jerardino *et al.* 1992 and was found further south than the Koignaas region (Fig. 1.5)**

UCT Archaeometry lab no./skeleton accession no.	N	C	C:N ratio (atomic)	Collagen yield	Burial	Site	Radiocarbon date	Calibrated radiocarbon date
12775	17.2	-16.4	3.2	17.8%	Partial skeleton	LK2004-011	800±70BP (GX-32523)	1273AD
10982	14.4	-13.1	3.0	22.0%	Noup burial	Near Koignaas	850±70BP (GX-32522)	1244AD
12756/UCT579	15.3	-12.8	3.2	23.4%	Somnaas burial #1	Near Koignaas	1250±70BP (GX-32527)	827AD
620/UCT172	14.3	-12.3	3.3	/	Kleinsee burial #1	Buffels River mouth	2100±50BP (GX-32537-AMS)	129BC
624/UCT164	16.1	-12.6	3.2	/	Kleinsee burial #2	Buffels River mouth	2240±50BP (GX-32542-AMS)	244BC
12758	16.4	-12.4	3.2	25.0%	Adult skull	Near Kleinsee	2500±50BP (GX-32539-AMS)	538BC
425/SAM-AP-4932	18.3	-14.8	3.2	23.1%	Kleinsee burial #3	Buffels River mouth	2660±60BP (GX-32541-AMS)	816BC
4447/UCT445	16.2	-14.8	3.3	/	Groen River burial*	Groen River mouth	2720±60BP (Pta-5617)	819BC
12776	15.2	-13.6	3.4	13.8%	SK300 burial	Near Kleinsee	2750±50BP (GX-32538-AMS)	867BC
12755	13.9	-14.0	3.2	22.6%	Juvenile	Near Kleinsee	2750±50BP (GX-32536-AMS)	867BC
12757	13.0	-18.4	3.2	5.4%	Somnaas burial #2	Near Koignaas	3490±80BP (GX-32528)	1743BC
591/SAM-AP-4931	16.6	-13.0	3.3		Kleinsee burial #4	Buffels River mouth	3820±50BP (GX-32540-AMS)	2208BC
12778	16.1	-14.5	3.5	25.5%	SK2006 burial #1	Buffels River mouth	?	?

Figure 14.1 ∂^{13}C and ∂^{15}N values for human and animal collagen from Namaqualand. Pink=humans, yellow=steenbok, yellow with black line is the modern steenbok, blue=springbok, mauve=hares, and green=duiker



Using the student t-test to identify differences in diet between the regions identified a significant difference between the mean ∂^{13}C from the two regions (t=1.925, df=10 at p=0.05), but not for the nitrogen values (t=1.307, df=10, p=0.05). However, the difference in ∂^{13}C values is due to the presence of the outlier, burial Somnaas #2 (Table 14.2) and when this individual is removed, there is no difference between the two regions (t=1.307, df=8, p=0.05).

In summary, it should be noted that the stable carbon and nitrogen isotope systematics in Namaqualand are complicated, and that the conclusions that can be drawn from this work are therefore limited. The results for human burials available to date do, however, contribute some useful information about diet. Most people ate mixed diets that incorporated both terrestrial and marine foods. While it is not possible to quantify precisely the relative importance of the two categories, it appears that the input from marine foods was limited. In particular, it seems that people did not consume large quantities of high trophic level marine foods, such as seals. This is of interest because most sites had seal remains, and some were near seal colonies.

Chapter Fifteen

Discussion

Namaqualand cultural sequence

The data derived from this study will be used to develop a reconstruction of the later Holocene prehistory of Namaqualand. This will be based initially on the open-air sites described above. Later in this chapter, I will incorporate results of research at sites in the immediate surrounds and the hinterland. Inter-site similarities and differences will be discussed with a focus on settlement location choices, cultural material, and subsistence strategies within the context of the changing palaeoclimate.

Comparison of the sites described above, indicates that there are more similarities than differences between the Buffels and Koignaas regions. In fact, patterns identified in this analysis do not depend on space, but on change through time. An exception to this rule is the presence of the shellfish species *Choromytilus meridionalis*, which is found only at the southern Koignaas sites.

Three cultural phases were identified in this study. The first phase begins with the earliest site, MB2005-05B, dated at 3645BC and continues through to the occupation at KV502 dated to 536BC. However, as the recent white sand dunes are dated to the mid-Holocene (Chase 2005), it is very possible that sites that predate the mid-Holocene are currently buried beneath the sand. In fact, MB2005-05B and KN6-3C were identified only after a large overburden of sand was removed. Samples from the first half of the Holocene may be limited by this factor. Evidence for the second phase begins at LK5-1east dated to 411BC, continuing through to LK5-1north, dated at 383AD; there are no open-air occupation events dated to the first millennium AD in this study, although there are dated occupation layers at Spoegrivier Cave (Webley 2002). Finally, the third and final phase is first identified at LK2004-011 dated to 1400AD and runs through to the 1641AD at MB2005-119. These phases are differentiated primarily on the basis of the frequency of formal tools, and the reduction in the use of the fine-grained material CCS. In terms of stone artefact technology, they reflect a continuous evolution of the Holocene microlithic cultural sequence (Deacon 1972, 1984a, Orton 2006) with no indication of abrupt changes.

3645BC-536BC Phase 1

There are four occupation units spanning three thousand years in this category, all with a similar cultural signature and use of the landscape. This is also the time of the transition from the arid mid-Holocene to the neoglacial wet and cool period, and the onset of the regression of sea level exposing the rocky headlands and plateaus, where shellfish beds are presently located. The four occupations, in chronological order, are MB2005-05B (3645BC), KN6-3C surface3 (2864BC), KN6-3C surface 1&2 (1500BC) from the Koignaas region and KV502 (536BC) from the Buffels region.

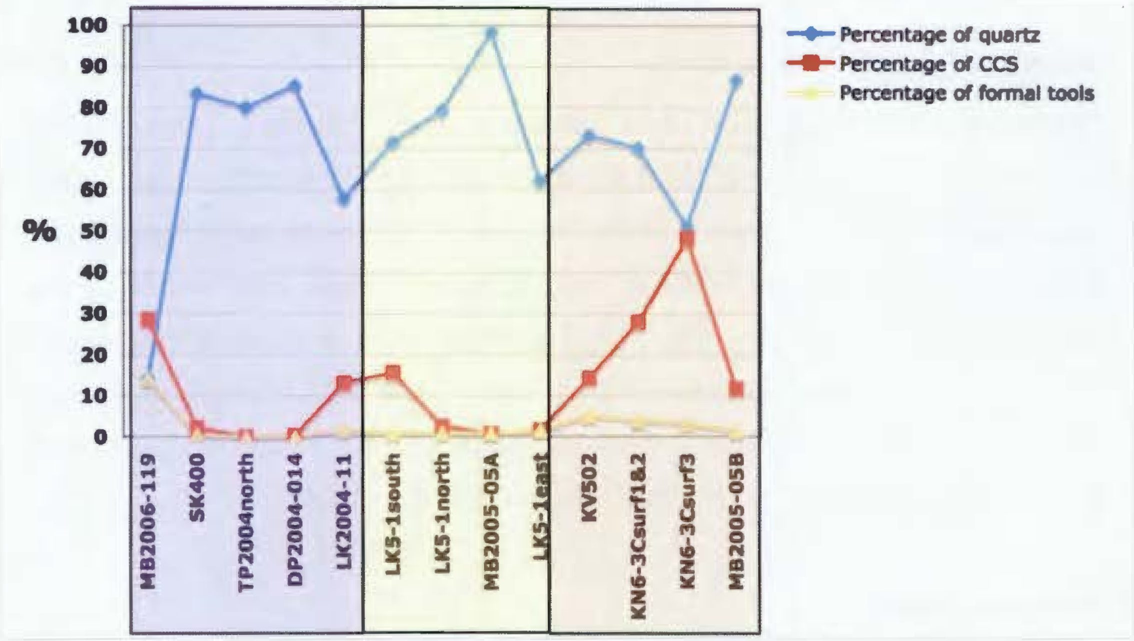
Settlement pattern

The three sites from the Koignaas region are within 300m of the shoreline and five kilometres from the nearest river, while KV502 from the northern region, is six kilometres inland and 18km from the nearest known fresh water source. Thus, there is variety in the choice of settlement location with people capable of settling away from rivers. They probably obtained water from local springs and/or transported it using water containers such as ostrich eggshell flasks. Either way, these people were well adapted to life in a desert.

Cultural material

During this era, the percentage of formal tools is the highest documented in this study, ranging from 1.5% of the lithic assemblage at MB2005-05B to 5.2% at KV502: the relative frequency of formal tools increases through time (Fig. 15.1). The dominant raw material at these sites is local quartz: milky quartz at KV502 in the north and quartz crystal in the southern Koignaas sites. However, CCS is also important, ranging from 11.7% to 48.3% of the total lithic assemblage. Thus, CCS was consistently favoured during this time period, compared to later ones (Fig. 15.1).

Figure 15.1 **Changing percentages of lithic raw material from sites dated to the mid Holocene (3645BC) on the right through to the late Holocene on the left (1641AD). The three colours distinguish the various phases**



The variety of formal tools also peaks during this era (Tables 15.1 & 15.2). These tools are made on both quartz and CCS: the quartz crystal formal assemblage is dominated by backed artefacts, while scrapers are much more likely to be made from CCS. The dominant tool type is variable between scrapers and backed tools, although the large lithic assemblages at KN6-3Csurf1&2 are dominated by backed tools and scrapers respectively (Tables 15.1 & 15.2).

Cores consist of bipolar, irregular, and single platform cores with bipolar and irregular cores more or less equally common (Table 15.3).

The use of "portable" grindstones is evident during this phase, with the earliest upper and lower grindstones present in the KN6-3C surf1&2 occupation (2864BC), although there is no evidence of seeds or bulbs: plant remains tend not to survive in shell middens. However, specularite and ochre, both pigments that require grinding to reduce them to a usable form, are present; Specularite in the lithic assemblage at MB2005-05B and ochre in KN6-3C surf3.

Table 15.1 The variety of scrapers in Namaqualand through time. The three colours distinguish various phases. MRPs are miscellaneous retouched pieces

	Side scrapers		Backed scrapers		Thumbnail scrapers		Double - sided scrapers		Boat shaped scraper		MRPs	
	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS
MB2006-119			1									
SK400											3	
TP2004north												
DP2004-014												
LK2004-11	2											
Total	**2**		**1**								**3**	
LK5-1south				1								
LK51north	1			2								
MB2005-05A	10	1	4	1		1					6	1
LK5-1east	1		1			1						
Total	**12**	**1**	**5**	**4**		**2**					**6**	**1**
KV502		10		4		2					3	3
KN6-3C surf1&2	1	12	1	12	5	5		1			2	14
KN6-3C surf3		3			1							
MB2005-05B	1	11	1	6						3		2
Total	**2**	**36**	**2**	**22**	**6**	**7**		**1**		**3**	**5**	**19**

Table 15.2 The variety of backed tools in Namaqualand through time. The three colours distinguish various phases. MBPs are miscellaneous backed pieces

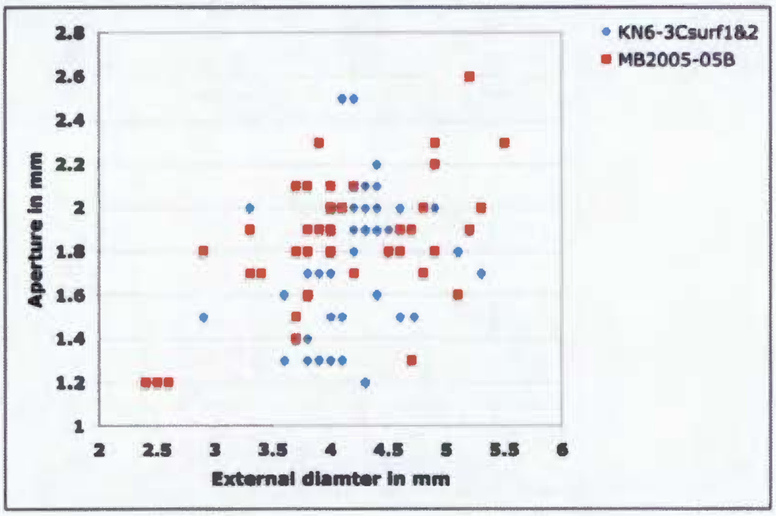
	Segments		Drills		Backed points		Backed blades		Backed bladelets		Backed flakes		MBPs	
	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS	Qtz	CCS
MB2006-119														
SK400														
TP2004north														
DP2004-014					1									
LK2004-11											1			
Total					**1**						**1**			
LK5-1south														
LK51north									1					
MB2005-05A		1	1		9	1	7		5		1		1	
LK5-1east		1												
Total		**2**	**1**		**9**	**1**	**7**		**6**		**1**		**1**	
KV502									2	1			2	
KN6-3Csurf1&2	4	2	2	41	3	3			1	11	1	5	2	15
KN6-3Csurf3				1					1			1		1
MB2005-05B	11	4			1	1	4		1		1			1
Total	**15**	**6**	**2**	**42**	**4**	**4**	**4**		**5**	**12**	**2**	**6**	**4**	**17**

Table 15.3 The variety and number of cores in Namaqualand through time. The three colours distinguish various phases

	Bipolar cores	Irregular cores	Single platform cores	Radial cores
SK400	6	5		
TP2004north		1		
DP2004-014	15	5	2	
LK2004-11		10	1	
LK5-1south	2	1	1	
LK51north	4	1	1	
MB2005-05A	45	16	15	1
LK5-1east	2	2	1	
KV502	11	9	2	
KN6-3C surf1&2	24	27	4	
KN6-3Csurf3		1	1	
MB2005-05B	26	18	4	

The ostrich eggshell beads from this phase are small and standardised. Two assemblages of beads both have mean external diameters of 4.2mm: 4.2±0.5mm for 40 beads at KN6-3Csurf1&2 and 4.2±0.6mm for 38 beads at MB2005-05B (Figure 15.2). This is remarkable as these sites span 1,500 years. KN6-3C surf1&2 has a stage 5 unfinished bead, suggesting that this temporary camp may have been occupied for a longer period of time than the others (cf. Jerardino 1995b).

Figure 15.2 The external diameter versus the aperture for ostrich eggshell beads from KN6-3C surf1&2 and MB2005-05B. Note the similarity



This phase produced the only decorated ostrich eggshell from three out of four sites. The motifs are simple multiple incised parallel lines and chevrons. One of the decorated pieces is a flask mouth fragment, indicating that water containers were being used and decorated. The occupation of KN6-3C surf1&2 also has the earliest bone beads in this study: they are flat and similar in form to ostrich eggshell beads but made on mammal rib bone. Both beads have external diameters of 9.1mm.

Table 15.4 **The presence of selected finds in Namaqualand through time. The three colours distinguish various phases**

	Ostrich eggshell beads Mean in mm	**Decorated ostrich eggshell**	**Bone beads**	**Bone tools**	**Shell pendants**	**Grind-stones**	**Buried tortoises**	**Decorated pottery**	**Specul -arite**	**Ochre**
MB2006-119	**8.5**									
SK400	**7.4***				**X**	**X**		**X**	**X**	
TP2004north	*****					**X**				
TP2004south								**X**		
DP2004-014	**5.5***			**X**	**X**	**X**	**X**			
LK2004-11	**5.3**		**X**	**X**	**X**	**X**				
LK5-1south	**5.8**									
LK5-1north						**X**	**X**			**1**
MB2005-05A	**3.3**			**X**		**X**			**X**	
LK5-1east						**X**	**X**			**1**
KV502						**X**				**12**
Kn6-3C surf1&2	**4.2***	**X**	**X**			**X**				**22**
KN6-3C surf3		**X**								**1**
MB2005-05B	**4.2**	**X**							**X**	

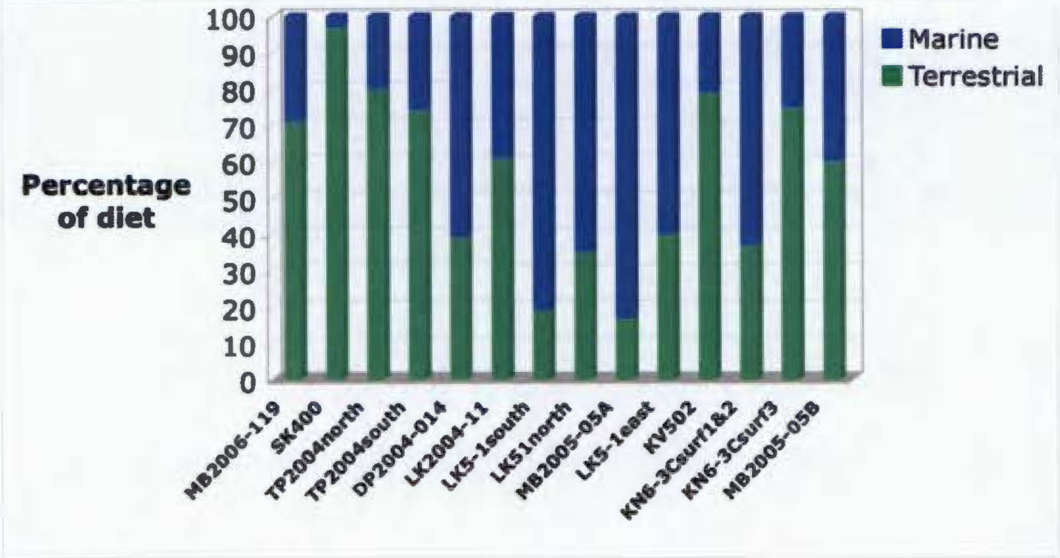
***Presence of at least one unfinished bead**

Subsistence strategy

The subsistence strategy is a typical generalist approach to the landscape: collecting a wide range of local species. The majority of kilojoules at these sites were obtained from terrestrial animals (Figure 15.3), especially small to medium size bovids. There are many broken teeth of a medium-large bovid (BovIII) at MB2005-05B, apart from which large bovids do not appear in the faunal assemblages in this study until the late Holocene.

The skeletal elements are always highly fragmented and consist of broken teeth and long bone shaft fragments. The high meat utility elements are never present, suggesting they have been collected and taken elsewhere. Recall that comparing the assemblages with bone density concluded that post-depositional processes did not greatly affect the bone assemblage. Thus, the pattern of bone refuse suggests that these were processing sites as opposed to base camps. While it is possible that these are the kill sites, this is unlikely as the smaller bovids are easily snared, while the larger bovids require tracking and hunting over large distances with either a bow and poisoned arrow or a spear. Thus, it is most likely that these sites are temporary camps where recently procured bovid meat and marine products were initially processed and eventually taken elsewhere.

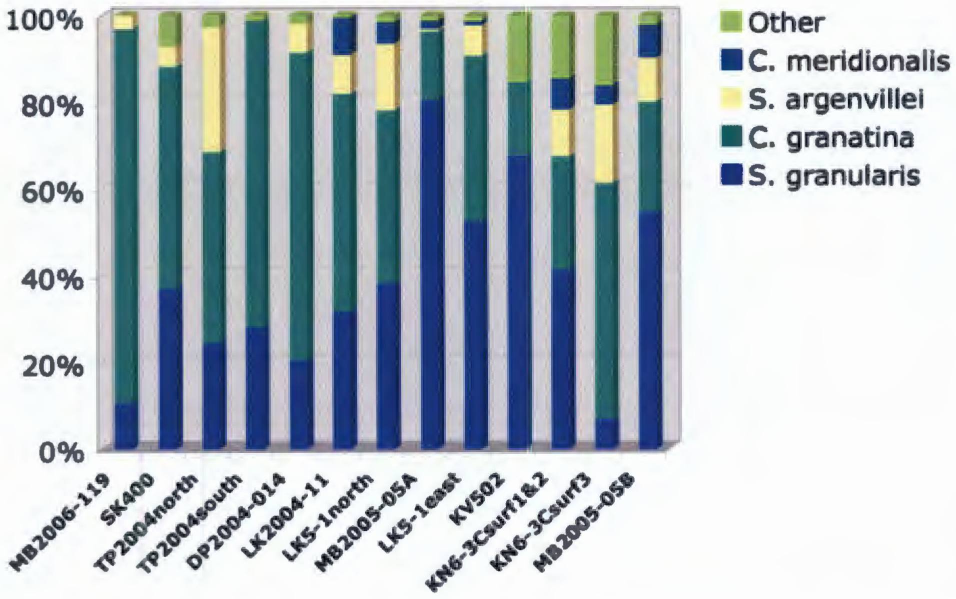
Figure 15.3 **Bar graph of the estimated percentages of terrestrial versus marine foods through time in Namaqualand**



While all the shellfish species are found on the same rocky headlands, people in these mid to late Holocene times occupations focussed on *S. granularis*: the most abundant species in these occupations with the exception of KN6-3C surf3 (Fig. 15.4). *S. granularis* is the smallest of the limpets, but it the most sun tolerant and thus the most accessible limpet as it lives high on the shoreline, and can be collected even at high tide. However, at KN6-3Csurf3, people focussed on the largest shellfish, *C. granatina* and particularly *S. argenvillei*, an exploitation strategy that requires a spring low tide, an approach that is not seen at any other occupation during this phase.

Cape fur seal was processed on these early sites, with a range of elements identified in the assemblage at MB2005-05B. This suggests that a Cape fur seal rookery was already established in Mitchell's Bay. The Buffels region, on the other hand, does not provide evidence for the exploitation of seal until 1462AD at DP2004-014. Today, the breeding colony is located near Kleinsee and DP2004-014, not at Mitchell's Bay. It seems that the seal rookery moved from Mitchell's Bay to Kleinsee some time before 1462AD. Fish, lizards, snakes and birds, particularly African penguin, were already being exploited but in low numbers, while crayfish and various shellfish species are important to the diet. There is also a cross section of the small mammals and carnivores present in this phase.

Figure 15.4 **Bar graph of the species composition of shellfish assemblages through time in Namaqualand**



The cultural sequence for the mid to late Holocene in Namaqualand is rich in artefact types with a variety of raw materials, exploited food species, and choice of site location. The culture is formalized with a high proportion of lithic formal tools, standardized ostrich eggshell, and bone beads. The decorated ostrich eggshell flasks may indicate a self-identifying culture. Also, the location of KV502, so far from a known fresh water source, and the use of flasks suggests a culture that was well adapted to an arid environment, even though it was probably a cooler and wetter landscape than today. As the occupation horizons appear to be short term processing sites, these people were probably fairly mobile and came to the coast to obtain supplies, while the base camps were located elsewhere: perhaps along the coastal plains that would be better protected from the southerly winds.

411BC-383AD Phase 2

The second phase covers at least 800 years and includes LK5-1east (411BC), MB2005-05A (100BC), LK5-1 north (383AD), and LK5-1 south. LK5-1south has pottery in the assemblage, suggesting that it dates to within the last 2000 years, while the lithics and the subsistence strategy suggest that it belongs in this group. The palaeoenvironment of these occupations is still relatively wet and cool in comparison to today. Compared with the earlier phase, there is a noticeable reduction in the use of CCS and the proportions of formal tools and an increase in the importance of seals in the diet.

Settlement location

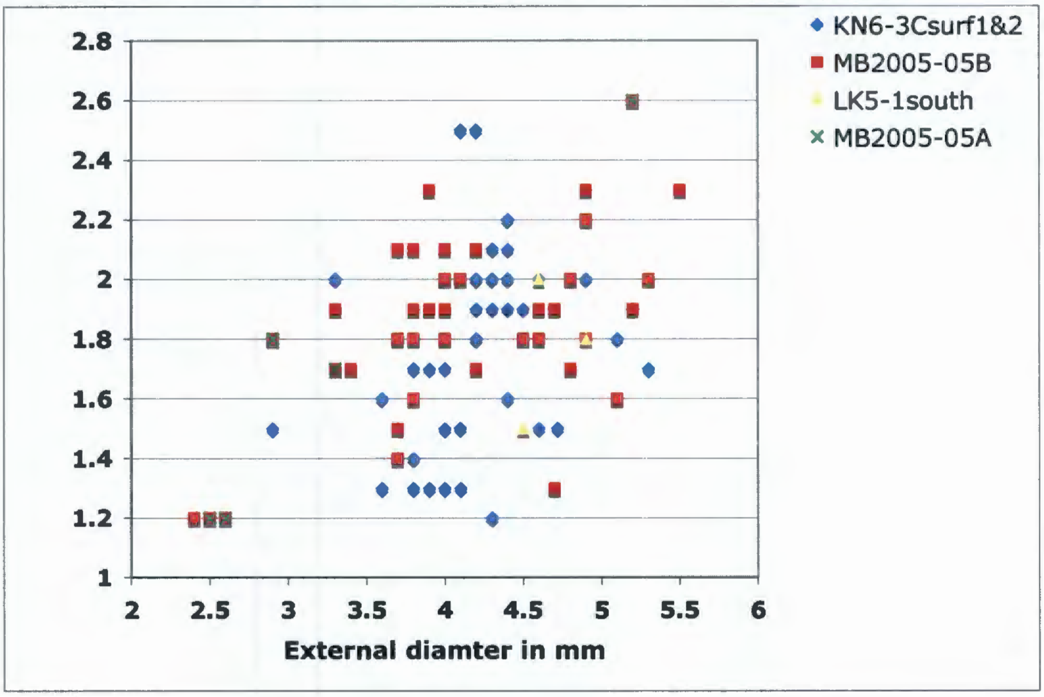
All four occupations are located in the Koignaas region, within 300m of the shoreline. While MB2005-05A is only 400m from the Spoeg River, the LK5-1 occupation units are 13km from Swartlinjies River, although nearby, now obscured by a prospecting trench, there may have been a fresh water channel. The season of occupation at MB2005-05A was determined to be summer, based on the presence of both adult male and newborn seals.

Cultural material

The formal tools contribute less to the overall lithic assemblage ranging from 1.8% at LK5-1south to 0.9% at MB2005-05A, although the variety of tool forms is maintained (Tables 15.1 and 15.2). The lithic assemblage is still dominated by local quartz crystal, while the contribution from CCS is reduced: from 15.6% at LK5-1south to 0.7% at MB2005-05A (Fig 15.1). With the reduced frequency of CCS, many more scrapers are made on quartz crystal (Table 15.1). Scrapers dominate the formal tools, except at MB2005-05A, where there are a similar number of backed tools (24 scrapers and 26 backed tools). Bipolar cores dominate the core forms (Table 15.3), suggesting a reduction in access to large good quality nodules, although both irregular and single platform cores are present in the assemblages.

The ostrich eggshell beads are still fairly small with mean sizes varying from 3.3±1.1mm for five beads at MB2005-05A to 5.8±0.2mm for four beads at LK5-1south. At first glance it seems as if the ostrich eggshell beads are no longer as standardized as the previous phase, however the sample size is small and the beads do fit within the same range (Fig 15.4). Thus, the beads could be manufactured in the same fashion as the previous phase.

Figure 15.5 **The external diameter versus aperture of ostrich eggshell beads from the previous phase with the beads from LK5-1south and MB2005-05A superimposed**

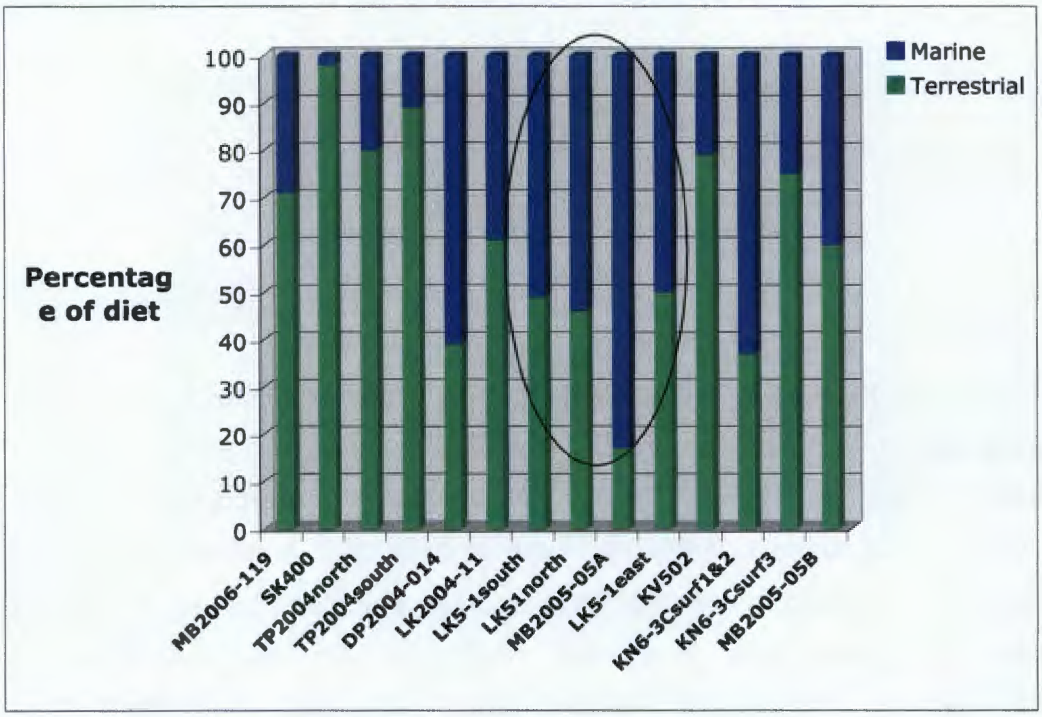


Grindstones continue to be present, as does specularite and ochre. This phase sees the appearance of bone tools in this study, with a broken tip of a bone point/awl found at MB2005-05A. A potential innovation is the intentional burial of intact tortoise carapaces, seen at both LK5-1north and LK5-1east (Table 15.4). The purpose of burying tortoises is unclear, but it is most likely related to some ideological or ritual practice. Pottery also makes its first appearance in Namaqualand at LK5-1south with eight sherds of a fine-grained good quality matrix and a mean wall thickness of 7.8±2.6mm within the range identified by Rudner (1968) for Namaqualand. The four rims have rounded lips and there is no decoration.

Subsistence Strategy

The diet in the second phase is much more reliant on marine foods than in earlier or later times (Fig. 15.3). The sites are all close to Mitchell's Bay, and seals certainly contribute to the marine orientation of the diet; however, if one removes seal from overall kilojoule estimation (Fig. 15.6), marine foods still dominate the diet at these sites (>50% of the diet). It is difficult to determine whether isolated teeth are present in the assemblages as the result of subsistence refuse, or if they had some symbolic importance.

Figure 15.6 **Bar graph showing the percentage of terrestrial versus marine foods in the diet with seal removed if it was present only as a single tooth such as the LK5-1 occupations or a single mandible such as SK400 and TP2004-04south. The removal of seal has very little impact on the SK400 and TP2004-04south assemblages. Oval indicates sites that make up second phase occupation, 411 BC to 383 AD**



Crayfish are consistently important at these sites compared with earlier ones, augmenting the marine component (ranging from 3.8 individuals/m^2 in phase 1 to 11.1 individuals/m^2 in phase 2). In addition, the relative contribution of shellfish to the diet stabilises between 21-33% of the total diet, whereas this value is variable at all other times ranging from 10-58% in the previous phase and 5-29% in more recent times. During this phase, the single most abundant shellfish species is once again *S. granularis*, the most easily accessible species, but the two other limpets and black mussel are also present in the shellfish assemblage (Fig 15.4). Of interest is the presence of *S. argenvillei* at these small short term processing sites, as it indicates that people were at these sites near or during spring tides.

The species that contribute the most to the terrestrial component of the diet are steenbok and bovid size class II (grey duiker or springbok). Applying quantitative analyses to the assemblages, it is clear that both unconstrained and bulk strategies were applied to the steenbok, whereby the carcass was returned to the site whole or the elements with the most meat were returned to the site, to be further processed accessing the long bones for the fatty bone marrow. Fundamentally, the refuse from these occupations indicates that their primary function was as processing sites, and if seals were being obtained for subsistence purposes, they would be the focus of the diet at those sites.

Fish, frogs, snakes, tortoises, birds (particularly African penguins) and small carnivores continue to be included in the faunal assemblages, although in low frequencies.

Thus, there is much continuity between the second phase and the earlier phase, including the palaeoenvironment, variety of tool forms, range of raw materials, size of ostrich eggshell beads, and the presence of grindstones and pigments. However, there is a reduction in the use of CCS, so that quartz crystal becomes the dominant raw material for making scrapers. The ratio of core forms also changes, with bipolar cores becoming much more prominent. In addition, bone tools become a feature of the assemblage along with pottery, and intentional burial of intact tortoises. The subsistence strategy shifts to a more marine diet through the more regular use of shellfish and an increase in the consumption of crayfish. The shellfish collection strategy seems to maintain focus on the most readily available species, even if they are the smallest. Seals become regularly represented at sites, for their abundant meat and fat or potentially for some ritual purpose, as they are sometimes present as a single tooth. The most important terrestrial source of meat is the smaller bovids, with steenbok and BovII toping the list of contributing species. Essentially, these are short term processing sites located close to the shore and specifically, close to the seal rookery at Mitchell's Bay.

1400-1641AD Phase 3

There is a gap in the series of open-air sites between approximately 400 - 1400AD, which corresponds to the Medieval Warm Epoch. There are a number of open-air sites, perhaps indicative of a pulse of occupation at the coast between about 1400 and 1641AD, but particularly towards the end of the 15th century. The timing of these sites is within the Little Ice Age, once again, a cool and wet period. The occupation events in chronological order are LK2004-011 (1400AD), DP2004-014 (1462AD), TP2004-04south (1479AD?), TP2004-04north (1479AD), SK400 (1480AD) and MB2005-119 (1641AD).

In this time period, there are two types of sites, the typical short term processing sites MB2005-119, TP2004-04north, and TP2004-04south and a second type, small campsites/processing sites, with evidence for longer periods of occupation and in some cases including gender based divisions of space in the form of bead and lithic manufacturing areas. Campsites include SK400, DP2004-014, and LK2004-011.

Settlement location

LK2004-011 and MB2005-119 are located in the Koignaas region, while the remaining four sites are in the Buffels region. While LK2004-011 is only 60m from the coast, the other occupations are between 800m and 2.3km from the coast. MB2005-119 and SK400 are only one km from the Spoeg and Buffels Rivers respectively, whereas DP2004-014 is 6.6km from the Buffels River, LK2004-011 is 12.2km from the Swartlinjies River, and the TP2004-04 occupations are 18km from the Buffels River. Thus, there is a wide range of site locations, from the shoreline to inland some distance from a known fresh water source. SK400 was occupied in summer, based on the dentition of the springbok juveniles, as was DP2004-014, based on the presence of both adult male and newborn seals.

Cultural material

The presence of formal tools wanes with a total of only nine formal tools from all six occupations. Two assemblages (TP2004-04north, TP2004-04south) lack any formal retouch whatsoever, while four sites yielded only one to three formal stone artefacts each (Tables 15.1 & 15.2). Local quartz still dominates the raw materials with milky quartz most common in the Buffels region and quartz crystal in the Koignaas region. CCS becomes even rarer than in phase 2 (Fig. 15.1), with no contribution to the formal tool category (Tables 15.1 & 15.2). While Figure 15.1 seems to suggest that CCS spikes at the most recent site MB2005-119, this is in fact insignificant, given that the lithic sample consists of only seven pieces. Thus, two CCS flakes give a false impression of the importance of CCS in the assemblage. Scrapers continue to dominate the formal tool assemblages, but the sample sizes are small. Bipolar, irregular, and single platform cores have been identified within this phase, but the ratio of core types fluctuates between sites (Table 15.3). Thus, there is no general pattern to the core forms during this phase. This is an informal expedient lithic industry.

Grindstones are found at four of the six sites, with specularite identified at SK400, suggesting that people continued to grind pigments. Specularite also appears in the temper of the pottery from this era. Decorated pottery sherds show impressed dots below the lip: a single line of dots at TP2004-04south and a double line of dots at SK400. All the decorated rims have rounded lips, while one rim from TP2004-04south has a pinched lip and three rims from SK400 have flat lips. The mean wall thickness is 5.0±1.7mm at TP2004-04south and 6.0±1.7mm at SK400, both within the expected range from Namaqualand (Rudner 1968). The diameters of the vessel mouths range from 20mm to 90mm, but the shapes of the bodies are unclear.

The ostrich eggshell beads get progressively larger through this time: 5.3±0.2mm for three beads at LK2004-011 (1400AD); 5.5±0.8mm for 31 beads at DP2004-014 (1462AD); 7.4±1.4mm for 182 beads at SK400 (1480AD); and 8.5mm for one bead at MB2005-119 (1641AD). Plotting all the beads from this time period (Fig. 15.7) there is clearly a bimodal distribution with some overlap at 7.0mm. The two older sites (LK2004-011 and DP2004-014) have smaller beads, similar in size to the small sample from the previous phase (Fig. 15.5). The beads from the two most recent sites include larger examples, with the intermediate aged site SK400 actually having beads in both size ranges. MB2005-119 yielded only one bead.

During this phase, unfinished beads are present in the assemblages of DP2004-014, TP2004-04north, and SK400. The two temporary base camps with unfinished beads, SK400 and DP2004-014, vary widely in the range and number of unfinished beads. SK400 has three stage ten beads (Kandel & Conard 2005) while DP2004-014 has a suite of stages represented by 82 unfinished beads and eight broken finished beads.

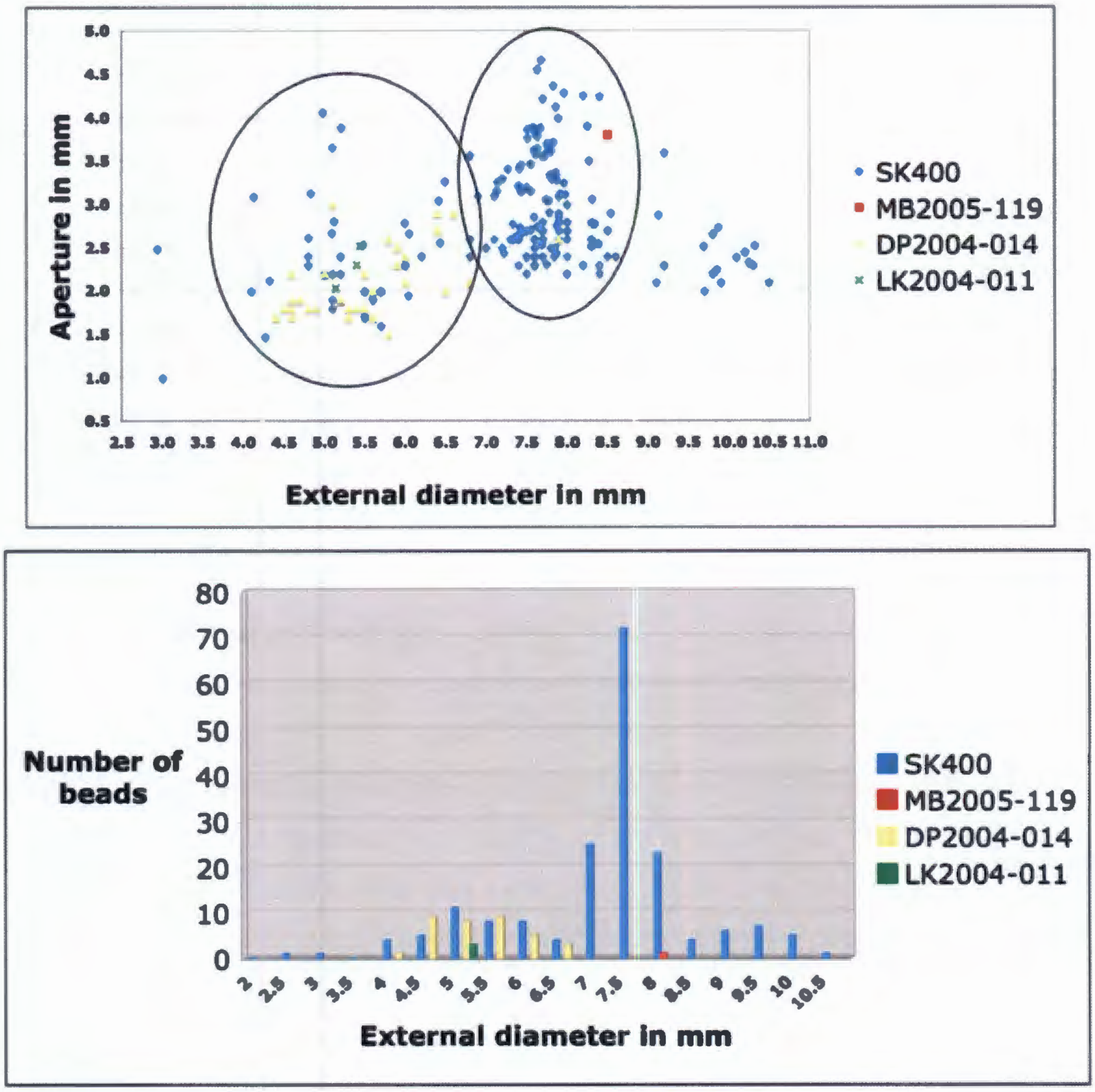
There is also a bone bead preform at LK2004-011 and shell pendants appear at this site and then again at DP2004-014 and SK400. While LK2004-011 has *Cowrie* shells, DP2004-014 and SK400 have *Conus* shell pendants.

The presence of bone tools continues, with a range of fragmented bone points/awls/linkshafts as well as a complete bone point. The intentional burial of tortoises continues during this era with an example from DP2004-014.

Subsistence Strategy

The dominant subsistence strategy during this phase is focussed on terrestrial animals (Fig. 15.3), with gemsbok returning as the largest meat animal: a pattern not seen since the mid-Holocene site of MB2005-05B. Smaller bovids still contribute to the diet. Faunal remains are from a broad range of species including more carnivores, birds, and fish, although in low frequencies. Sites specializing in mass harvesting appear: springbok at SK400 and penguin and tortoises at LK2004-011, while people at DP2004-014 focussed on seals. This strategy has far reaching social implications but of particular interest is that mass harvesting is occurring at the same time as the high ranked gemsbok are being hunted.

Figure 15.7 **Scatterplot and bar graph of external diameter versus aperture of ostrich eggshell beads at LK2004-011, DP2004-014, SK400, and MB2005-119. Note the bimodal distribution**



Perhaps the increase in the use of small mammals and carnivores in conjunction with the penguin pelts and springbok signals the importance of pelts to keep warm in winter as this phase is during the Little Ice Age. Seals are still being hunted with animals present at all sites except MB2005-119 and TP2004-04north, (although these are both small processing sites). However, of particular interest and noted above, is that the SK400 and TP2004-04south seals are represented by one mandible at each site.

The economic strategies identified at these sites include unconstrained and gourmet strategies. When the sample sizes were too small to identify specific strategies, the remains were more often than not just the crania and foot bones. This suggests that at times, people were returning whole animals to the site to undergo primary butchery (unconstrained) and then the best parts of meat were taken away (gourmet): the seals and small bovids were usually exploited this way. The gemsbok usually underwent primary butchery elsewhere, probably at the kill site, and the long bones were returned to the site for secondary marrow processing.

The shellfish collection strategy shifts to focussing on *C. granatina* over *S. granularis*, the dominant species of the previous eras (Fig. 15.4). *C. granatina* tend to occur slightly lower in the mid inter-tidal zone than *S. granularis*, thus *C. granatina* requires a low tide to harvest, but they are larger and provide many more kilojoules than *S. granularis*. The lack of *S. argenvillei* at TP2004-04south suggests that this short term processing site was not occupied near or during a spring tide. Only LK2004-011 has *C. meridionalis,* but why this should be so is unclear.

This pulse of occupation, from 1400-1642AD, occurs during the Little Ice Age, when temperatures were lower and there was more precipitation. The choice of site location is variable and does not seem to be connected to rivers. Quartz becomes even more important in the lithic assemblages, with scrapers dominating over backed tools, but this industry consists primarily of expedient flakes rather than formal tools. Cores are variable and not dominated by any one form, although bipolar cores are still made suggesting some of the conservatism identified in the previous phase. Grindstones and pigments continue to be utilised as well as bone tools. Cultural innovations of the previous phase such as intentionally buried tortoises and bone beads persist. New innovations at sites in this study include larger ostrich eggshell beads that are less standardized, the use of shell beads, and the introduction of decorated pottery. Gemsbok and seals are hunted, although seals are less important than the previous phase. The mass harvesting of springbok, penguin, and tortoise is introduced although the exact nature of this is unknown but may be linked to obtaining pelts to combat the decrease in temperatures. This phase is suggestive of a continuation of the breakdown in the standardization identified from the mid-Holocene, but less characteristic of sites from the second phase.

Input from stable isotope analysis

Now that three phases have been identified it is of interest to determine if there is a change through time in the diet identified in the stable isotopes, especially since there was no real difference between the burials based on region. Seven individuals are radiocarbon dated to within the first phase with a mean ∂^{13}C value of -14.4±1.9‰, ranging from with -12.4‰ to -18.4‰ and a mean ∂^{15}N value of 15.7±1.8‰, ranging from 13.0‰ to 18.3‰. Two burials are radiocarbon dated to the second phase with ∂^{13}C values of -12.3‰ and -12.6‰, and ∂^{15}N values of 14.3‰ and 16.1‰. Three burials range in age from 827AD-1273AD and have a mean ∂^{13}C value of -14.1± 2.0‰, ranging from -12.8‰ to -16.4‰, and a mean ∂^{15}N value of 15.7±1.4‰, ranging from 14.4‰ to 17.2‰. Using the student t-test, there is no statistical difference in isotope values between these phases (first sequence and second sequence $t=0.24$, $df=8$, $p=0.05$; first sequence and third sequence $t=1.35$, $df=7$, $p=0.05$; second sequence and third sequence $t=1.105$, $df=3$, $p=0.05$). The results from the burials from the second phase are particularly interesting, as the archaeological material suggests that seals become more important, yet based on the stable isotope analysis, there is no indication that people were eating large quantities of seals even in phase 2. Sample size is however, small with only two individuals, both from the Buffels region, while the four sites dated to the second phase are near Mitchell's Bay and thus close to the seal rookery. Clearly, more data is required.

However, what is interesting is the clustering of burials between 867BC and 129BC: seven of the twelve human burials. This pulse of burials spans the first and second phases, a time of transition, which happens to correspond to an increase in the number of burials and probably of population in the southern Cape (Sealy 2006) and the south-west Cape (Sealy & van der Merwe 1988) between 3000-2000BP. However, what are very different are the isotope signatures and the settlement patterns. In the south-western Cape, only 200km south, this period is called the megamidden period, and the isotopes point to a clearly marine dominated diet (Jerardino 1997, Sealy & van der Merwe 1988). There is also a corresponding change in settlement practice with people moving out of caves and living at the coast, depositing enormous (>1000m^3) *Choromytilus meridionalis* middens with very little else in the assemblages (Jerardino 1997, Jerardino & Yates 1997, Jerardino *et al.* 2006). This is a very different signature to the small discrete limpet middens (<10m^3) and terrestrial diet isotope signatures of the Namaqualand sequences. So how does the cultural sequence of the people who lived at the desert coast of Namaqualand fit into the greater picture of southern African prehistory?

Namaqualand and its place in the prehistory of southern Africa

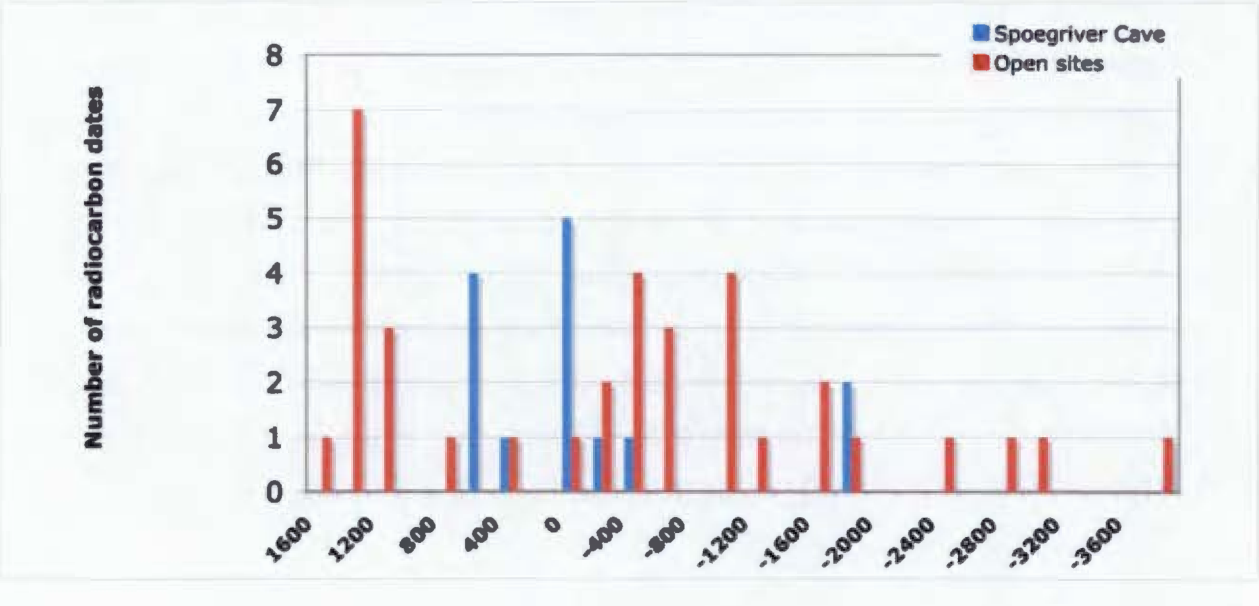
The earliest evidence of the human occupation of Namaqualand begins with the presence of Acheulian artefacts indicating an Early Stone Age presence. This is interesting as the Namaqualand coastal desert may have had wetter and cooler periods, but it has exhibited desert conditions since the Miocene, ranging only from semi- to hyper-arid. This suggests that *Homo erectus* or early *Homo sapiens* had the ability to survive and adapt to desert conditions, although they did eventually migrate out of Africa and populated colder regions. This in itself has far reaching implications and will be the topic of future research.

There are also Middle Stone Age deposits, such as Boegoeberg 2, although these have yet to be investigated thoroughly. Preliminary observations have identified both Still Bay points and Howiesons Poort segments in the coastal region of Namaqualand (personal observation) and Howiesons Poort segments in the hinterland (90km inland) at Wolfkraal (Webley 1984), indicating some occupation of the region between 75,000 and 60,000 years ago.

To date, there is no evidence for the occupation of Namaqualand during the earliest phases of the Later Stone Age. In fact, the only evidence for human presence in the region in the late Pleistocene and early Holocene is the large scraper industry identified in the basal layers 15 and 16 of Spoeg River cave (Webley 2002). These layers have not been dated due to the lack of associated organic material; however, the artefacts are typical of the terminal Pleistocene/early Holocene macrolithic. There are similar assemblages at Elands Bay Cave in the south-western Cape (Parkington 1988, Parkington *et* *al.* 1988), Wonderwerk Cave in the interior of the Northern Cape (Humphreys & Thackeray 1983), and Apollo 11 Cave in southern Namibia (Wendt 1972). Following the early Holocene macrolithic period, c. 8000BP sees the onset of the mid-Holocene warm phase, which in the winter rainfall zone was also arid. Both Apollo 11 (6030±65BP KN-609; 9120±90BP KN-610), Wonderwerk Cave (7430±60BP Pta-2798) and Little Witkrans (7470±70BP Pta-2490) have evidence for occupation during this time (Humphreys & Thackeray 1983, Wendt 1972) although the micromammal species from Wonderwerk Cave suggest it was a wet period (Avery 1981). A new radiocarbon date at 6135±40BP (Pta-113296) from DFM1, an open site in the south-western Cape near Elands Bay Cave, suggests that there was at least minimal occupation there as well (Orton and Compton 2006). However, the overall pattern is that there was relatively little occupation between 8000 and 4300BP in the interior of the country, and at Elands Bay (Deacon 1974, Parkington 1988, Wadley 1997). This may also be true of Namaqualand, but as the Namaqualand coast is covered in dunes of a mid-Holocene age, there is potential to find older sites buried beneath the dunes. The earliest occupation at site MB2005-05B, described above, is dated to shortly after 5000BP (5390±70BP, minus 500years for marine correction is 4890±70BP or 3645BC).

With the onset of the neoglacial period at 4200BP, there is much more evidence of human occupation on the Namaqualand coast, the Richtersveld, the middle Orange River, the south-western Cape, and the Eastern Cape (Deacon 1974, Hall 1990, Parkington 1988). KN6-3Csurf3 (2684BC or 4130BP marine corrected), Kn6-3Csurf1&2 (1509BC or 3240BP marine corrected), KV502 (536BC or 2440BP marine corrected), Spoegrivier Cave Layer 12 (1761BC or 3520BP), and Spoegrivier Cave layer 13 (1780BC or 3520BP) are well within the neoglacial period (Fig. 15.8 & Table 15.5). In addition, the hinterland also shows signs of occupation with layers dated at Die Toon to 3840BP and 3110BP (Webley *et al.* 1993), and Jakkalsberg N and L at 4500BP and 3330BP respectively (Orton 2007). There are also pulses of occupation along the Middle Orange River, from 4500-4300BP and again at 2600-2300BP (Beaumont *et al.* 1995) and continued occupation at Wonderwerk at 2910BP (Humphreys & Thackeray 1983). The settlement strategy is varied at the coast, ranging from a cave site, to open-air sites at the coast, near to rivers, and inland sites many kilometres from the nearest river. The open-air sites are typically short-term processing sites, while the presence of unfinished beads at Spoegrivier Cave suggests more prolonged visits. Lithic assemblages of this period have a high frequency of formal microlithic tools, dominated by local quartz, with CCS as the second most important raw material. The ratio of scrapers to backed artefacts fluctuates, but of note is the paucity of adzes and segments compared to the Eastern and Southern Cape coasts (Deacon 1972, 1984b) and the south-western Cape (Mazel & Parkington 1978, Thackeray 1977). If segments are related to hunting with bows and arrows, then perhaps their low numbers have to do with the fact that the majority of the animal species identified in the archaeological assemblages are more easily snared. This could also apply to the relative scarcity of bone points. The lack of adzes is in accordance with the lack of bored stones, and presumably digging sticks, all associated with digging up geophytes and digging stick maintenance (Clark 1958, Mazel & Parkington 1978, Mitchell 2002, Sampson 1972). There is very little wood in Namaqualand, so making and maintaining digging sticks would be difficult. Perhaps women were too busy collecting shellfish when on the coast to pay attention to geophytes. If, however, they did collect geophytes, digging sticks and bored stones might not have been essential items of equipment, since the soils along the coastline tend to be sandy and loose.

Figure 15.8 **The distribution of calibrated radiocarbon dates through time with AD on the left and BC on the right. Only the most likely calibrated date has been plotted in each case**



One observation of interest is that the fragments of decorated ostrich eggshell from Spoegriver Cave have a different motif: cross hatching (Webley 2002), as opposed to the parallel lines and chevrons identified on decorated ostrich eggshells from the open sites, although parallel lines, crosshatching, and chevrons are common in the Northern Cape (Rudner 1953) and are typical motifs found at Wonderwerk Cave and Little Witkrans shelter during this period. Also, decorated ostrich eggshell continues in the assemblage at Spoegriver Cave for a longer period than the open-air sites, until c. 2000BP, while Wonderwerk Cave has decorated ostrich eggshell through to layer 1 (layer 2b is dated to 1210±50BP Pta-2779) (Humphreys & Thackeray 1983).

Table 15.5 Radiocarbon dates for the coastal strip of Namaqualand. The dates are positioned chronologically based on calibrated dates. The yellow identifies the occupation layers from Spoegrivier cave, while the pink identifies human burials. *Radiocarbon dates from these units are based on marine shell and been corrected for the marine reservoir effect by subtracting 500 years; all other dates are based on bone or charcoal. Spoegrivier Cave dates are published in Webley (2002). Rooiwal Midden and Rooiwal Hollow dates are published in Orton *et al.* (2005). The burial UCT445 from the Groen River Mouth is published in Jerardino *et al.* (1992). ELK14 and ELK4 are sites with engraved ostrich eggshell that have yet to be fully analysed. **marine correction presented in Orton *et al.* 2005

Occupation	Layer	Radiocarbon date/marine corrected	Calibrated date	Lab number
MB2005-119	/	850±60BP* (350BP)	1641AD	GX-32521
SK400	Surface	370±45BP	1482AD	Pta-9124
TP2004-04	/	990±60BP* (490BP)	1479AD	GX-32058
SK400	Lower1	420±45BP	1478AD	Pta-9105
SK400	Surface	430±45BP	1469AD	Pta-9106
DP2004-014	/	1020±60BP* (520BP)	1462AD	GX-32060
LK2004-11	Midden3	1080±50BP* (580BP)	1431AD	GX-32059
Rooiwal midden	/	1110±50BP* (580BP)**	1415AD	Pta-8910
LK2004-11	Midden1	1200±60BP* (700BP)	1327AD	GX-32057
LK2004-11 partial burial	/	800±70BP	1273AD	GX-32523
NOUP burial	/	850±70BP	1244AD	GX-32522
UCT579 Somnaas burial #2	/	1250±70BP	827AD	GX-32527
Spoegrivier cave	Lens YBS	1260±50BP	798AD	GrA-9027-AMS
Spoegrivier cave	Lens CST	1450±50BP	700AD	Pta-6750
Spoegrivier cave	Hearth 3	1390±50BP	670AD	Pta-4753
Spoegrivier cave	Lens YBS	1490±50BP	628AD	GrA-9030-AMS
Spoegrivier cave	Lens Patella	2020±60BP* (1520BP)	562AD	Pta-6334
Spoegrivier cave	Lens GAS2	1890±50BP	160AD	GrA-9029-AMS
Spoegrivier cave	Lens GAS2	1900±50BP	144AD	GrA-9032-AMS
Spoegrivier cave	Lens SAS	1900±50BP	144AD	GrA-9028-AMS
Spoegrivier cave	Hearth 12	1920±40BP	128AD	Pta-4745
Spoegrivier cave	Lens Twiggy6	1930±50BP	120AD	Pta-6749
Rooiwal Hollow	/	2060±20BP	6AD	Pta-8915
UCT172 burial	/	2100±50BP	129BC	GX-32537-AMS
SK300	/	2640±60BP* (2140BP)	174BC	Pta-9310

UCT164 burial	/	2240±60BP	244BC	GX-32542-AMS
MB2005-05A	Layer2A	2560±60BP* (2060BP)	294BC	GX-32524
MB2005-05A	Layer2C	2620±70BP* (2120BP)	356BC	GX-32525
LK5-1north	/	2180±50BP* (1680BP)	383BC	Pta-9326
Spoegrivier cave	Lens SAS	2400±25BP	398BC	Pta-7200
LK5-1east	/	2870±60BP* (2370BP)	411BC	Pta-9312
Spoegrivier cave	Lens FBS	2105±65BP	498BC	OxA-3862-AMS
KV502	/	2940±45BP* (2440BP)	536BC	Pta-9306
Kleinsee adult skull	/	2500±50BP	538BC	GX-32539
SAM4932 burial	/	2660±50BP	816BC	GX-32541-AMS
SK300 burial	/	2750±50BP	867BC	GX-32538-AMS
Kleinsee Juvenile	/	2750±50BP	867BC	GX-32536
ELK 14	/	3410±70BP* (2910BP)	1122BC	GX-32056
UCT445 Burial	/	2720±60BP	1185BC	Pta-5617
KN6-3Csurf1&2	Surf1 F16	3720±45BP* (3220BP)	1496BC	Pta-9335
KN6-3Csurf1&2	Surf1 M18	3740±60BP* (3240BP)	1509BC	Pta-9325
Somnaas burial # 2	/	3490±80BP	1743BC	GX-32528
Spoegrivier cave	Hearth 34	3520±50BP	1761BC	Pta-6754
Spoegrivier cave	Lens BSB2	3580±60BP	1780BC	Pta-6987
SAM4931 Burial	/	3820±50BP	2208BC	GX-32540-AMS
KN6-3Csurf3	Surf3 M18	4630±70BP* (4130BP)	2684BC	Pta-9316
ELK4	/	4820±60BP* (4320BP)	2903BC	GX-32061
MB2005-05B	/	5390±70BP* (4890BP)	3645BC	GX-32526

The subsistence strategy focuses on small meat packages such as small bovids, small ground dwelling game such as tortoise, shellfish, crayfish, and sea birds. Most of these species are plentiful and/or reproduce rapidly, are predictable, and easily collected. However, large game such as gemsbok was hunted sporadically as seen at MB2005-05B and throughout the Spoegrivier cave sequence (Webley 2002). Of note is the lack of any evidence for the larger species present in the region, such as eland *(Taurotragus oryx*), black rhinoceros (*Diceros bicornis*), elephant (*Loxodonta africana*), quagga (*Equus quagga*), hippopotamus (*Hippopotamus amphibius*), and giraffe (*Giraffa camelopardalis*). Cape fur seal was exploited, but this is not strongly reflected in the bone collagen of the human burials recovered from this period. In fact, the stable carbon and nitrogen isotopic analyses identify a diet dominated by terrestrial species, with some contribution from low trophic level marine species, probably shellfish.

During this same period, 200km to the south, there was a marked increase in the number of coastal midden sites and human burials, probably indicating an increase in population size. This correlates with much greater reliance on lower ranked food items that could have been stored, especially *Choromytilus* *meridionalis.* The archaeological signature of this shift in emphasis is the development of the megamiddens (3000-2000BP). Human skeletal remains from this period have stable isotope values that indicate strongly marine-oriented diets.

In Namaqualand, although seven of the twelve burials investigated in this thesis date from 1185-129BC (2720-2100BP) (Table 15.5), the shift to exploiting low-ranked marine species and possibly to a delayed-returns strategy did not occur. So while populations very likely increased in Namaqualand, as elsewhere in southern Africa, this probably did not happen to such an extent that it required strategies such as the use of storage and shifting to lower ranking species.

The second phase identified in this study dates from 411BC-700AD (2370-1450BP), which overlaps the 'megamidden period' (3000-2000BP) further to the south. The stone assemblages from this period are very similar to those of the previous phase, but quartz is much more important, and CCS less so, than in earlier times, especially at Rooiwal Hollow (2060BP marine corrected) (Orton *et al.* 2005). In addition, formal tools are less frequent, which is consistent with the evolution of the Holocene microlithic tradition throughout southern Africa, towards a more informal industry.

During this period of occupation within the post neoglacial cool period from 2000-1050BP (Table 2.1), there is continued occupation of the Richtersveld at /Ai Tomas at 1980BP (Webley 1992), and at Jakkalsberg A and B at 1300BP and 1380BP respectively (Webley 1997). Doornfontein (1120±40BP Pta-187) and Springbokoog (1670±50BP Pta-6790 and 1270±50BP Pta-4103) also have dates for this period. Layers 3b and 2 at Wonderwerk Cave are dated to 1890BP and 1210BP respectively (Humphreys & Thackeray 1983) and southern Namibia is re-occupied, with an occupation layer at Skorpion Cave dated to 1340BP (Kinahan & Kinahan 2006).

Between 411BC-700AD (2370-1450BP), faunal assemblages from three southern Namaqualand sites were dominated by Cape fur seals, a high-ranking food item: five individuals at MB2005-05A, ten individuals at Rooiwal Midden (Orton *et al.* 2005) and 21 individuals in layer nine at Spoegrivier Cave (Webley 2002). All these sites are relatively close to the potential seal rookery at Mitchell's Bay, perhaps giving an inflated impression of the importance of seals in the diet. The human burials on which stable isotope analysis was conducted all came from the northern Buffels region, 50km to the north. They do not show a strongly marine diet, let alone substantial dependence on high trophic level seals. The most parsimonious explanation for this contradiction is that people in the Buffels region did not have access to the seal midden at Koignaas, and the modern-day seal rookery just north of the Buffels River had not yet been established. This is an interesting hypothesis and deserves further study. The abundance of seals at Spoegrivier Cave indicates that they were an important food species, as they were further south along the west coast (Klein & Cruz-Uribe 1996). There is however, the issue of a number of sites (LK5-1north, LK5-1east, LK5-1south, SK400, and TP2004-04south), yielding only a single seal tooth or mandible. Do these represent food refuse or did they hold some unknown, perhaps symbolic meaning? Animals that move between realms, such as flying birds and snakes, were given special significance by the /Xam informants of the Northern Cape (Bleek & Lloyd 1911). Thus, seals may also have had special importance as they live both on land and in the sea, and are an unusual marine animal as they suckle their young, and breathe air (Sealy 2006). While there is no direct ethnographic description of the importance of seal teeth, it is possible that they held some symbolic value.

The period 411BC-700AD (2370-1450BP) also sees the appearance of sheep and pottery in the region, with the oldest sheep bone in South Africa identified at Spoegrivier Cave and directly dated to 2105±65BP (498BC). Pottery appears one hundred years later, at 1930±50BP (120AD) at Spoegrivier Cave (Webley 2002). However, the artefact assemblages remain virtually identical, apart from the greater variation in the sizes of ostrich eggshell beads: larger ones are introduced in conjunction with the smaller beads. In addition, although the numbers of formal tools declined, the forms and variety of tools did not, suggesting continuity through time. Thus, there is little evidence to indicate that a new population moved into the region. This also applies to Jakkalsberg A and B and Wonderwerk Cave, although they do have higher frequencies of potsherds sherds and evidence for domesticates.

The sheep identified at Spoegrivier cave are present in small numbers with the highest NISP in layer 5 at 38 elements, or a minimum of five individuals

(Webley 2002). Total NISP for the entire site is 108, distributed across ten layers. Seals and wild bovids (steenbok etc.) contribute much more to the diet than domestic animals. The age profile of the sheep includes the whole range of individuals, from neonates to adults, causing Webley (2002) to conclude that the presence of sheep at Spoeg River Cave was due to 1) hunter-gatherers who obtained sheep from herders, 2) hunter-gatherers who were herding sheep on a small scale, or 3) herders who used the cave as a seasonal stockpost. Through four years of archaeological surveying and excavation in the region, I have never identified a single sheep bone. None of the faunal assemblages reported in this thesis contain sheep. It seems likely, therefore that the cave must have had some specific importance, either as a hiding spot or as a stock post, or both, as it has yielded all the archaeological sheep bone from Namaqualand to date.

Pottery appears in the region as undecorated sherds. So far, decorated pottery appears in the first half of the first millennium AD in layer 5 at Spoeg River Cave (layer 6 dates to 1930BP: 144AD and layer 3 dates to 1450BP; 628AD), and is present until layer 3, where it is most abundant. There is only one motif, incised horizontal lines below the rim and one refitted type C neck (after Rudner 1968), typical of first millennium AD pottery (Sadr 2003). Pottery is not present in the open-sites from this study until much later

at LK5-1south (undated) and/or DP2004-014 at 1462AD (520BP marine corrected).

The uppermost layers at Spoeg River Cave have yielded micromammal species that according to Avery (1992) indicate a reduction in the number of grass dwelling species. She has interpreted this as an indication that the environment was becoming more arid. This occurs from 1390BP to 1260BP (670-789AD) (Table 15.5), at the onset of the global Medieval Warm Epoch dated elsewhere (including South Africa) to 1050BP (Tyson *et al.* 2000). Once more it seems that deserts may be more susceptible to change than temperate environments, with the small, moist habitat specific species, micromammals, affected first. After 1260BP (789AD), for the duration of the Medieval Warming Epoch, there is so far no evidence for human occupation in Namaqualand, the Richtersveld, or southern Namibia.

The re-occupation of Namaqualand in the second millennium AD occurs with the onset of the Little Ice Age (1327-1641AD: 700-350BP), although there are two human burials present in the southern Koignaas region by 850BP and 800BP (1244 and 1273AD) (Table 15.5). In the Richtersveld, Bloeddrift 23 at the Orange River is occupied at 355BP (Smith *et al.* 2001) as well as /Ai Tomas at 420BP (Webley 1992). Bloubos has an occupation layer dated to 840±80BP but correction for ostrich eggshell places the date at 660BP (Pta-7819), while Skorpion Cave and Apollo 11 are occupied after the Little Ice Age at 180BP (Kinahan & Kinahan 2006) and 250BP respectively (Wendt 1972). The site of Bloeddrift 23 also dates to this period at 355±15BP (Pta-7942). Reliable archaeological evidence for the Namaqualand coast at this time period is at present restricted to the open-air sites including Rooiwal Midden at 580BP (Orton *et al.* 2005): Spoeg River Cave may have been occupied during this period, but the modern use of the cave as a camp site caused Webley to distrust the reliability of surface material (1998, 2002).

The types of open sites identified in this phase include small base camps in addition to the short term processing sites seen in the previous phases. One example of a base camp is DP2004-014, where there is evidence for gender specific activity areas where bone tools were found and ostrich eggshell beads were manufactured: typical trade items that may indicate a system of risk reduction through long distance trade.

Lithic assemblages are becoming less formal with more use of quartz flakes, similar to the Doornfontein industry of the Middle Orange River. When formal tools are present, they fluctuate between backed tools and scrapers, and are typically made on quartz, as the use of CCS has all but been abandoned. This shift to an informal quartz industry is also seen at Bloeddrfit 23 with one formal tool (a quartz crystal backed bladelet), Skorpion Cave and Apollo 11 (a few backed tools at Skorpion Cave and no formal tools at Apollo 11) and the Elands Bay sites from 1000BP onwards (Orton 2007).

The subsistence strategy in Namaqualand continued to use the local available species, with a reduction in the importance of seals. The establishment of the Buffels River seal rookery occurred by at least 1462AD (1020BP) as shown by the presence of adult males and newborns at DP2004-014, but these seals were not exploited in the same numbers as the Mitchell's Bay colony. Mass harvesting of springbok and penguins is introduced, even though large bovids (gemsbok) were hunted throughout this period. Perhaps these people were not mass harvesting springbok and African penguins for food alone, but were collecting the pelts to be used as capes and cloaks. Clearly, there would have been social implications of such bounty, and with little evidence for storage, the most likely result of the windfall would have been to strengthen long distance trade relationships based on the ethos of sharing.

While there is no evidence for sheep during this phase of occupation, there is a little pottery: 160 sherds from SK400, of which one is decorated, and 83 sherds from TP2004-04south, of which seven are decorated, assuming TP2004-04south has a similar date to TP2004-04north. Decoration consists of impressed dots below the lip, while the vessel forms are unclear. This is of interest because, elsewhere along the west coast, impressed decoration is typically associated with the earliest pottery in the first millennium AD (Sadr 2003). Further work is needed to gain a better understanding of the ceramic sequence in Namaqualand, and the extent to which it is consistent with that documented elsewhere on the west coast.

A comment on mobility: most researchers agree that the level of mobility among hunter-gatherers is linked to the predictability of resources, the distance between them, and the effort it takes to procure them (Binford 1981, Hitchcock 1982, Kelly 1995). Food resources available on the Namaqualand coast were relatively bountiful, predictable and easy to acquire, especially shellfish, crayfish, and seals, thus requiring limited mobility. The sites, however, are small and reflect only short stays i.e. a mobile lifestyle. The major force behind the need for mobility is probably the paucity of standing water even during "wetter" periods. This suggests that either people were constantly on the move, or else campsites that were inhabited for longer periods were located further inland, as water availability increases significantly as one gets closer to the mountains. The third and latest phase of occupation has evidence for longer-stay campsites than the simple processing sites of the earlier phases, an increase in the manufacturing of trade goods such as ostrich eggshell beads and bone points, as well as the bounty associated with mass harvesting. This may imply an increase in social and economic risk reduction through trade or sharing in response to the increase in population.

Overall, there seem to be many regions of occupation identified by slight differences in the use of raw materials, dominant tool types, and the make up of the pottery matrix. The Ghaap escarpment utilises local fine-grained materials throughout the Holocene with end scrapers dominating the tools from the end of the mid-Holocene on. The Middle Orange River area consists of a backed blade industry that according to Beaumont *et al.* (1995) splits into two industries with the introduction of ceramics: the Swartkop industry continued the use of backed blades and coarse pottery with grass temper; and the Doornfontein industry consists of an informal expedient flake industry with thin-walled ceramics and an increase in the presence of metal objects. The Richtersveld sites are all dominated by quartz followed by a local fine-grained material. The dominant formal tools fluctuate between backed tools and scrapers: either side scrapers or backed scrapers. The Orange River sites also have more sheep and pottery than any other sites discussed in this study. The southern Namibian sites of Skorpion Cave and Apollo 11 fluctuate between CCS and quartz dominated assemblages, and the formal tools at Skorpion Cave consist of CCS side and end scrapers, a borer and one quartz crystal segment. The pottery at both sites is undecorated and there is no evidence for sheep. The Namaqualand signature is also dominated by local quartz, with milky quartz in the Buffels regions and quartz crystal in the Koignaas region. CCS is present in high frequencies in the early sites, but is all but abandoned by the Little Ice Age. The formal tools fluctuate between scrapers and backed tools, but side scrapers, backed scrapers, backed bladelets, and backed points are common, while segments and adzes are rare. In fact, the Namaqualand sites are similar to the Richtersveld sites in artefact composition, but they lack the continued use of fine-grained materials, and abundance of pottery and sheep seen in the Richtersveld. In addition, the site of DFM1 from the south-western Cape is more similar to the coastal sites of Namaqualand than it is to the surrounding sites, with a quartz crystal backed bladelet industry similar to the Rooiwaal sites. Assemblages in the Elands Bay region consists of local quartz and silcrete and are typically dominated by scrapers until 1000BP, when lithic assemblages begin to shift towards a more informal industry, also seen at varying times at sites in

Namaqualand, the Richtersveld, southern Namibia, and the Middle Orange River region.

Decorated ostrich eggshell is found across southern Africa with similar motifs from Namaqualand to the Ghaap escarpment. Also, the pottery decoration and vessels are similar across the northern and western Cape, with spouts and lugs common to all regions, and other than the Middle Orange River sites, most temper consists of sand.

The similar range of tools and decoration motifs suggests that there is some contact or cultural tradition being maintained at great distances but each region has its own flavour, most likely due to the set of opportunities available at each place.

Chapter Sixteen

Conclusion

The late Holocene period in southern Africa saw people moving into ecologically marginal regions, with the onset of the Neoglacial period c. 4200BP. During this time, one can see more evidence of occupation in Namaqualand, where people utilised a range of settlement locations including a cave, open-air sites located at the shore, coastal dunes, and inland areas. The open-air sites in Namaqualand consist of many small sites distributed along the coastline, with little evidence for people returning to the same location, except for Spoeg River Cave. This makes for a different kind of archaeology in comparison to other parts of the South African coastline such as the 'megamiddens'. This has some advantages in that most sites are less confusing with little to no over printing, a typical problem especially in cave sites. However, it makes for a lot of piecing together in order to develop a broader picture, as each site is a glimpse into a short-term occupation. In the two sites for which the season of occupation could be determined, it was summer, the dry season. People relied on immediately local resources, with no evidence of truly exotic materials being brought into the region. The subsistence strategy is generalist and includes high-ranking species such as Cape fur seal and gemsbok throughout the late Holocene. In the later half of the second millennium AD mass harvesting is introduced, even though high-ranking species are still being hunted. Archaeological remains and the stable carbon and nitrogen isotopes values of human skeletons suggest that the diet was oriented mainly towards terrestrial species with some input from marine foods, especially shellfish. Evidence for boundaries is lacking; lithic raw materials, which can be used as a stylistic marker (cf. Hall 1990), are used the same way throughout Namaqualand and the hinterland of the Richtersveld. The focus on local quartz and the reduction in the use of fine-grained materials in more recent times is characteristic even beyond Namaqualand, as far south as the south-western Cape. One of the few apparently consistent spatial variations in archaeological assemblages within the study area is the lack of seals in the Buffels region, while the Koignaas region sites have seals in the faunal assemblage. Non-lithic artefact types are similar across large areas, such as bone points, decorated ostrich eggshell, decorated pottery, and the sizes of ostrich eggshell beads. Differences in the formal tool assemblages are most likely task specific. Thus, in Namaqualand where ground game is more numerous, trapping or snaring was probably used more often. The small sizes of the sites, and the low diversity of artefacts suggest that people were highly mobile, staying at sites for a short periods, until the mid-second millennium AD, when we see more evidence for base camps, the increased manufacturing of potential trade items, and the employment of mass harvesting.

Elsewhere in South Africa, archaeological sites from the second half of the Holocene have been interpreted in terms of population pressure, increased sedentism, and possibly the development of delayed-returns strategies. In the Elands Bay area of the south-west Cape, these processes have been suggested for the 'megamidden period' between 3000 and 2000BP. In the southern Cape, and in the eastern Cape on the Fish River, evidence for increased territoriality dates back to the mid-Holocene. This pattern does not however, appear to apply in Namaqualand or the Richtersveld. While people in the more temperate zones show some signs of becoming more "complex" hunter-gatherers, as a reaction to stress, the people who exploited the Namaqualand coast were maintaining a highly mobile, immediate returns strategy, consistent with a lower population in a more ecologically marginal area.

Surprisingly, the introduction of domesticated sheep appears not to have had a profound effect on the archaeological signatures in Namaqualand. While the earliest evidence for sheep is found here, it comes only from Spoegrivier Cave, and is more consistent with small-scale utilisation of stock, rather than full-blown pastoralist behaviour: the quantity of sheep bone is small with wild species continuing to dominate the assemblages, and the age profiles of the sheep do not reflect a purposeful culling pattern of slaughtering young males. In addition, not one sheep bone has been identified in the many open sites investigated to date, both those reported in this thesis and others excavated in the course of archaeological mitigation prior to mining. There is relatively little pottery. In Namibia, Kinahan (1991) has concluded that pastoralism is a local indigenous development, supporting the diffusion (rather than the migration) theory of pastoralist origins. In coastal Namaqualand, too, there is little evidence to suggest that pastoralism was introduced with a migrating population. There is no indication of a substantial change in cultural material nor is there evidence for boundaries, increased ritual, or population pressure. Thus, so far, the evidence suggests that the earliest introduction of sheep and pottery into Namaqualand was through diffusion, although the mindset that accompanies a delayed-returns system, making the transition from a sharing ethos to ownership easier, had not developed. The best evidence for the use of sheep and pottery is found near the Orange River, the area most likely to support large breeding herds, and later at Kasteelberg, to the south. If pastoralism did arrive with a migrating population, they most likely hugged the mountainous interior of Namaqualand, where water is more dependable, and travelled straight through to the southern regions of the Cape. Further research in the Kamiesberg Mountains will be required in order to address this question more fully. It is worth noting here that Sampson's research suggests that pastoralists did not enter South Africa via the Seacow Valley either (Sampson 1972, Sampson *et al.* 1989, Sampson & Plug 1993).

Specifically, this research project identified the exploitation of the 'trekbokken' at SK400, a phenomenon that until now was undocumented archaeologically: during a severe drought many springbok flock to the sea in a lemming-like daze. In addition, the faunal assemblage from KV502 made it clear that humans need to be recognised as intentional hunters of micromammals, and should be included in the category 5 list of predators. The identification of a seal rookery at Mitchell's Bay and potentially a penguin hatchery at Langklip (LK2004-011) will be beneficial to zoologists reconstructing the long-term history of breeding colonies.

Finally, people were best able to exploit the arid Namaqualand desert when it was wetter and cooler than current conditions, with access to drinking water the factor most likely to have affected mobility. Future work should attempt to further define the chronology of the cultural sequence, and to incorporate more of the many as yet undated open-air sites referred to at the beginning of this thesis. Future research into the Middle and Early Stone Age occupations, as well as the search for further evidence for occupation during the early Holocene macrolithic will be exciting. There is also a need for more local palaeoenvironmental evidence, which will be the next task of this research programme. Finally, there is a great deal of potential for comparing the results from this thesis with research from other desert regions such as Australia and South America, in order to conduct a pan hemispheric study of human adaptation to desert environments.

References Cited

Acocks, J.P.H. 1988. Veld types of South Africa: Memoirs of the Botanical Survey of South Africa. No. 57 3rd ed. Cape Town.

Ambrose, S.H. 1991. Effects of diet, climate and physiology on nitrogen isotope abundances in terrestrial foodwebs. *Journal of Archaeological Science* 18: 293-317.

Andrews, P. and Evans, E.M.N. 1983. Small mammal bone accumulations produced by mammalian carnivores. *Paleobiology* 9 (3): 289-307.

Andrews, P. 1990. Owls, caves, and fossils. London: Natural History Museum Publications.

Avery, G. 1977. Report on the marine bird remains from the Paternoster midden. *South African Archaeological Bulletin* 32: 74-76.

Avery, G. 1985. Late Holocene use of penguin skins: evidence from a coastal shell midden at Steenbras Bay, Luderitz Peninsula, South West Africa-Namibia. *Annals of the South African Museum 96* (3): 55-65.

Avery, D.M. 1981. Holocene micromammalian faunas from the Northern Cape Province, South Africa. *South African Journal of Science* 77:265-273.

Avery, D. M. 1992. Micromammals and the environment of early pastoralists at Spoeg River, Western Cape Province, South Africa. *South African Archaeological Bulletin* 47:116-121.

Baxter, A. and Meadows, M. 1999. Evidence for Holocene seal level change at Verlorenvlei, Western Cape, South Africa. *Quatemary International* 56: 65-79.

Beaumont, P. Boshier, A. 1974. Report on test excavations in a prehistoric pigment mine near Postmastburg, Northern Cape. *South African Archaeological Bulletin* 29: 41-59.

Beaumont, P. Smith, A., and Vogel, J. 1995. Before the Einiqua: The archaeology of the frontier zone. In A. Smith (ed.) Einiqualand: studies of the Orange River Frontier. Cape Town: UCT Press.

Behrensmeyer, A.K. 1978. Taphonomic and ecological information from bone weathering. Paleobiology 4(2): 150-162.

Biesele, M. 1993. Women like meat. Johannesburg: Witwatersrand University Press.

Binford, L. 1981. Bones: Ancient men and modern myths. New York: Academic Press.

Binford, L. 1978. Nunamuit ethnoarchaeology. New York: Academic Press.

Biggar, H.P. 1922-1936. The works of Samuel Champlain (6 vols) Toronto: The Champlain Society.

Bleek, W.H.I., and Lloyd, L.C. 1911. Specimens of Bushmen folklore. London: George Allen.

Buchanan, W.F. 1985a. Sea shells ashore. PhD thesis. University of Cape Town.

Buchanan, W.F. 1985b. Middens and mussels: an archaeological enquiry. *South African Journal of Science* 81: 15-16.

Buikstra, J. E. and Swegle, M. 1989. Bone modification due to burning: Experimental Evidence. In: Bonnichsen, R. and Sorg, M.H. (eds.) Bone Modification: 247-258. Orono: University of Maine.

Burch, E. S. jr. 1972. The caribou/wild reindeer as a human resource. *American Antiquity* 37 (3): 339-368.

Chase, B. 2005. Late quaternary palaeoenvironments of the west cost of South Africa: the Aeolian record. PhD thesis. University of Oxford.

Clark, J. 1958. Stone Age woodworking tools in southern Africa. *South African Archaeological Bulletin*. 13: 144-152.

Cockcroft, M., Wilkinson, M, and Tyson, P. 1987. The application of a present-day climatic model to the late Quaternary in southern Africa. *Climatic Change* 10:161-181.

Cohen, A. Parkington, J., Brundit, G., and van der Merwe, N. 1992. A Holocene marine climate record in mollusk shells from the southwest African coast. *Quaternary Research* 38: 379-385.

Cooke, C. 1965. Evidence of human migration from the rock art of southern Rhodesia. *Africa* 35:3: 263-285.

Crandall, B.D. and Stahl, P.W. 1995. Human digestive effects on a micromammal skeleton. *Journal of Archaeological Science* 22: 789-797.

Cullinan, P. 2006. Robert Jacob Gordon: 1743-1795. The man and his travels at the Cape. Websitepublication: http://web.uct.ac.za/depts/age/people/Gordon.

Deacon, H.J. 1976. Where hunters gathered: a study of Holocene Stone Age people in the Eastern Cape. Claremont: South African Archaeological Society.

Deacon, H.J. 1993. Planning an idea: an archaeology of Stone Age gatherers in South Africa. *South African Archaeological Bulletin* 48:86-93.

Deacon, H.J., and Deacon, J. 1999. Human beginnings in South Africa: uncovering the secrets of the Stone Age. Cape Town: David Phillip Publishers.

Deacon, J. 1972. Wilton: an assessment after fifty years. *South African Archaeological Bulletin*. 27: 10-48.

Deacon, J. 1974. Patterning in the radiocarbon dates for the Wilton/Smithfield complex in southern Africa. *Southern African Archaeological Bulletin* 29: 3-18.

Deacon J. 1984a. Later Stone Age people and their descendants in southern Africa. In (ed.) R.G. Klein, Southern African palaeoenvironments and prehistory. 221-328. Rotterdam: Balkema.

Deacon, J. 1984b. The Later Stone Age of southernmost Africa. Oxford: British Archaeological Reports International series 213.

Deacon, J. & Lancaster, N. 1988. Late Quaternary palaeoenvironments of southern Africa. Oxford: Oxford University Press.

d'Errico, F., Henshilwood, C., Vanhaeren, M., van Niekerk. K. 2005. Nassarius kraussianus shell beads from Blombos Cave: Evidence for symbolic behaviour in the Middle Stone Age. *Journal of Human Evolution* 48:3-24.

Denys, C., Fernandez-Jalvo, Y., Dauphin, Y. 1995. Experimental taphonomy: preliminary results of the digestion of micromammal bones in the laboratory. Paris. *Comptes Rendue de l'Acadamie des Sciences* 321: 803-809.

Dewar, G, Halkett, D., Hart, T., Orton, J., and Sealy, J. 2005. Implications of a mass kill site of springbok (*Antidorcas marsupialis*) in South Africa: hunting practice, gender relations and sharing. *Journal of Archaeological Science* 33: 1266-1275.

Dewar, G. and Jerardino, A. 2007. Micromammals: when humans are the hunters. Journal of Taphonomy (*in press*).

Dunn, E. J 1875. South African antelopes. *Cape Monthly Magazine*. New Series 11: 289-293.

Eitel, B. 2005. Environmental history of the Namib Desert. In M. Smith and P. Hesse (eds.) 23°S: archaeology and environmental history of the southern deserts. Chapter 4: 45-55. Canberra: National Museum of Australia

Eitel, B., Kadereit, A., Blumel, W., Huser, K., and Kromer, B. 2005. The Amspoort silts, northern Namib Desert (Namibia): formation, age, and palaeoclimatic evidence of river-end deposits. *Geomorphology* 64: 299-314.

Elphick, R. 1977. Kraal and castle: Khoikhoi and the founding of white South Africa. New Haven and London: Yale University Press.

Erlandson, J. 2001. The archaeology of aquatic adaptations: paradigms for a new millennium. *Journal of Archaeological Research* 9 (4) 287-350.

Estes, R. D. 1991. The behaviour guide to African mammals. Halfway House: Russell Friedman books.

Faith, J.T. and Gordon, A.D. 2006. Skeletal element abundances in archaeofaunal assemblages: economic utility, sample size, and assessment of carcass transport strategies. *Journal of Archaeological Science* doi: 10.1016/j.jas.2006.08.007

Fernandez-Jalvo, Y. 1995. Small mammal taphonomy at La Trinchera de Atapuerca (Burgos, Spain). A remarkable example of taphonomic criteria used for stratigraphic correlations and palaeoenvironment interpretations. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 114: 167-195.

Goede, A., McDermott, F., Hawkwsworth, C., Webb, J., and Finlayson, B. 1996. Evidence of Younger Dryas and neoglacial cooling in a late Quaternary palaeotemperature record from a speleothem in Victoria, Australia. *Journal of Quaternary Science* 11: 1-7.

Grün, R., Brink, J., Spooner, N., Taylor, L. Stringer, C., Franciscus, R. and Murray, A. 1996. Direct dating of Florisbad hominid. *Nature* 382: 500-501.

Halkett, D.J. 2003. A report on the archaeological mitigation program at DeBeers Namaqualand mines March 2002 to June 2003. Unpublished report for DeBeers Namaqualand Mining Company.

Halkett, D. J., Hart, T, Yates, R, Volman, T. P., Parkington, J. E., Orton, J, Klein, R, Cruz-Uribe, K, and Avery, G. 2003. First excavation of intact Middle Stone Age layers at Ysterfontein, Western Cape Province, South Africa: implications for Middle Stone Age ecology. *Journal of Archaeological Science* 30: 955-971.

Hall, S. 1990. Hunter-gatherer-fishers of the Fish River basin: a contribution to the Holocene prehistory of the Eastern Cape. unpublished PhD: University of Cape Town.

Haydon, A.E.F. 1969. Notes on the biology of *Panulirus homarus* and on length/weight relationships of *Jasus lalandii*. Investigational report No. Division of sea fisheries of South Africa 69:1-27

Henshilwood, C. 1996. A revised chronology for pastoralism in southernmost Africa: new evidence of sheep at c. 2000 b.p. from Blombos Cave, South Africa. *Antiquity* 70: 945-949.

Henshilwood, C., Nilssen, P., and Parkington, J. 1994. Mussel drying and food storage in the Late Holocene, SW Cape, South Africa. *Journal of Field Archaeology* 21: 103-109.

Henshilwood, C., d'Errico, F., Yates, R., Jacobs, Z., Tribolo, C., Duller, G., Mercier, N., Sealy, J., Valladas, H., Watts, I. and Wintle, A. 2002. Emergence of modern human behavior. Middle Stone Age engravings from South Africa. *Science* 295: 1278-1280.

Hitchcock, R. 1982. Patterns of sedentism among the Basarwa of eastern Botswana. In E. Leacock and R. Lee (eds.) Politics and history in band society. Cambridge: Cambridge University Press. 223-267.

Humphreys, A.J.B. 1974. The occurrence of ostrich egg shells filled with specularite in the Northern Cape. *South African Journal of Science* 70: 48.

Humphreys, A.J.B. and Thackeray, A.I. 1983. Ghaap and Gariep: Later Stone Age studies in the Northern Cape. Cape Town: The South African Archaeological Society Monograph Series No. 2.

Inskeep, R. 1987. Nelson Bay Cave, Cape Province, South Africa: the Holocene levels. British Archaeological Reports international series 357 (i).

Jacobs, Z., Duller, G., Wnitle, A. and Henshilwood, C. 2006. Extending the chronology of deposits at Blombos Cave, South Africa, back to 140ka using optical dating of single and multiple grains of quartz. *Journal of Human Evolution* 51: 255-273.

Jerardino, A. 1993. Mid- to Late-Holocene sea-level fluctuations: the archaeological evidence at Tortoise Cave, south-western Cape, South Africa. *South African Journal of Science* 89: 481-488.

Jerardino, A. 1995a. Late Holocene neoglacial episodes in southern South America and southern Africa: a comparison. *Holocene* 5:361-368.

Jerardino, A. 1995b. The problem with density values in archaeological analysis: a case study from Tortoise Cave, Western Cape, South Africa. *South African Archaeological Bulletin* 50: 21-27

Jerardino, A. 1997. Changes in shellfish species composition and mean shell size from a Late-Holocene record of the west coast of southern Africa. *Journal of Archaeological Science*. 24: 1031-1044.

Jerardino, A. and Yates, R. 1997. Excavations at Mike Taylor's Midden: a summery report and implications for a re-characterisation of megamiddens. *South African Archaeological Bulletin* 51: 7-16.

Jerardino, A., Branch, G., and Navarro, R. 2006. Archaeological perspectives on human impacts on marine resources of the west coast of South Africa. J. Erlandson & T.C. Rick (eds.) In: Human impacts on marine environments. Berkeley: University of California Press.

Jerardino, A., Navarro, R., and Nilssen, P. 2001. Cape rock lobster *(Jasus lalandii)* exploitation in the past: estimating carapace length from mandible sizes. *South African Journal of Science* 97: 59-62.

Jerardino, A., Yates, R, Morris, A., and Sealy, J. C. 1992. A dated human burial from the Namaqualand coast: Observations on culture, biology and diet. *South African Archaeological Bulletin* 47: 75-81.

Johnson, E. 1985. Current developments in bone technology. In M.B. Schiffer (ed.) *Advances in archaeological method and theory* 8: 157-235. New York: Academic Press.

Kandel, A. & Conard, N. 2005. Production sequences of ostrich eggshell beads and settlement dynamics in the Geelbek Dunes of the Western Cape, South Africa. *Journal of Archaeological Science* 32: 1711-1721.

Katzenberg, M.A. 1992. Advances in stable isotope analysis of prehistoric bones. In S. Saunders & M.A. Katzenberg (eds.) Skeletal biology of past peoples: Research Methods: 105-119. Toronto: Wiley-Liss.

Kelly, R. 1995. The foraging spectrum: Diversity in hunter-gatherer lifeways. Washington DC: Smithsonian Institution Press.

Kent, S. 1993. Sharing in an egalitarian Kalahari community. *Man*. 28 (3): 479-514.

Kinahan, J. 1991. Pastoral nomads of the central Namib Desert. Windhoek: New Namibia books.

Kinahan, J., and Kinahan, J.H.A. 2003. Excavation of a late Holocene cave deposit in the southern Namib Desert, Namibia. *Cimbebasia* 18: 1-10.

Kinahan, J., and Kinahan, J.H.A. 2006. Preliminary report on the Late Holocene archaeology of the Awasib-Gorrasis Basin complex in the southern Namib Desert. *Studies in the African Past* 5: 1-14.

Klein, R. 1972. The Late Quaternary mammalian fauna of Nelson Bay Cave (Cape Province, South Africa): its implications for megafaunal extinctions and environmental and cultural change. *Quaternary Research* 2: 135-142.

Klein, R. 1974. Environment and subsistence of prehistoric man in the southern Cape Province, South Africa. *World Archaeology* 5: 249-284.

Klein, R. 1978a. Stone Age Predation on Large African Bovids. *Journal of Archaeological Science* 5: 195-217.

Klein, R. 1978b. A preliminary report on the larger mammals from the Boomplaas Stone Age cave site, Cango Valley, Oudsthoorn district, South Africa. *South African Archaeological Bulletin* 33: 66-75.

Klein, R. 1987. Large mammal and tortoise bones from Elands Bay Cave and nearby sites, Western Cape Province, South Africa. *South African Archaeological Bulletin* 38: 26-30.

Klein, R. 1989a. Faunal evidence for prehistoric herder-forager activities at Kasteelberg, Western Cape Province, South Africa. *South African Archaeological Bulletin* 44:82-97.

Klein, R. 1989b. Biological and Behavioural Perspectives on Modern Human Origins in Southern Africa. P. Mellars and C. Stringer (eds.) In The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans. Princeton: Princeton University Press.

Klein, R. 1991. Size variation in the Cape Dune Molerat (*Bathyergus suillus*) and Late Quaternary climatic change in the southwestern Cape Province, South Africa. *Quaternary Research* 36: 243-256.

Klein, R. 1992. The Archaeology of Modern Human Origins. *Evolutionary Anthropology* 1: 5-14.

Klein, R. 1999. The Human Career: Human Biological and Cultural Origins (2nd ED.) Chicago: The University of Chicago Press.

Klein, R. 2000. Archaeology and the Evolution of Human Behaviour. *Evolutionary Anthropology* 9: 17-36.

Klein, R. & Cruz-Uribe, K. 1987. In J. Parkington & M. Hall (eds.) Papers in the Prehistory of the Western Cape, South Africa. Oxford: British Archaeological Reports pp. 132–163.

Klein, R. and Cruz-Uribe, K. 1989. Faunal evidence for prehistoric herder-forager activities at Kasteelberg, Western Cape Province, South Africa. *South African Archaeological Bulletin* 44:82-97.

Klein, R. and Cruz-Uribe, K. 1996. Exploitation of large bovids and seals at Middle and Later Stone Age sites in South Africa. *Journal of Human Evolution* 31: 315-334.

Klein, R., Cruz-Uribe, K., Halkett, D., Hart, T., and Parkington, J. 1999. Paleoenvironmental and Human Behavioural Implications of the Boegoeberg 1 Late Pleistocene Hyena Den, Northern Cape Province, South Africa. *Quaternary Research* 52: 393-403.

Lam, Y.M., Chen, X., and Pearson, O.M. 1999. Intertaxonomic variability in patterns of bone density and the differential representation of bovid, cervid, and equid elements in the archaeological record. *American Antiquity* 64 (2): 343-362.

Lam, Y.M., Pearson, O.M., Marean, C.W, Chen X. 2003. Bone density studies in zooarchaeology. *Journal of Archaeological Science* 30: 1701-1708.

Lam, Y.M. and Pearson, O.M. 2004. The fallibility of bone density values and their use in archaeological analyses. *Journal of Taphonomy* 2 (2): 99-116.

Lee, R. 1979. The !Kung san: men, women, and work in a foraging society. Cambridge: Cambridge University Press.

Legge, A.J and Rowley-Conwy, P.A. 1987. Gazelle killing in stone age Syria. *Scientific American*. August 257 (2): 76-83.

Le Roux, A. and Schelpe, E.A.C.L.E. 1981. Namaqualand and Clanwilliam: South African wild flower guide. Cape Town: The Cape Department of Nature and Environmental Conservation.

Lewis-Williams, J. and Dowson, T. 1999. Images of power: understanding Bushman rock art. Johannesburg: Southern Books.

Lupo, K. and Schmitt, D.N. 2005. Small prey hunting technology and zooarchaeological measures of taxonomic diversity and abundance: ethnoarchaeological evidence from Central African forest foragers. *Journal of Anthropological Archaeology* 24: 335-353.

Lyman, R.L. 1985 Bone frequencies: Differential transport, in situ destruction, and the MGUI. *Journal of Archaeological Science* 12: 221-236.

Lyman, R.L. 1994. Vertebrate Taphonomy. Cambridge manuals in archaeology. Cambridge: Cambridge University Press.

Madsen, D.B. and Kirkman, J. 1988. Hunting hoppers. *American Antiquity.* 53: 593-604.

Madsen, D. B, and Schmitt, D. N. 1998. Mass collecting and the diet breadth model: a Great Basin example. *Journal of Archaeological Science* 25: 445-455.

Maggs, T. and Ward, V. 1980. Driel Shelter: rescue at a Later Stone Age site on the Tugela River. *Annuls of the Natal Museum.* 24 (1): 35-70.

Manson, J. 1984. Aspekte van die Biologie en gedrag van die Kaapse Grysbok. unpublished Master's thesis. University of Stellenbosch.

Marean, C. 1991. Measuring the post-depositional destruction of bone in archaeological assemblages. *Journal of Archaeological Science* 18: 677-694.

Matthews, T. 2002. South African micromammals and predators: some comparative results. *Archaeometry* 44(3): 363-370.

Mazel, A. 1989. People making history: the last ten thousand years of hunter-gatherer communities in the Thukela Basin. Natal Museum *Journal of Humanities* 1: 1-168.

Mazel, A. and Parkington, J. 1978. Sandy Bay revisited: variability among Late Stone Age tools. *South African Journal of Science* 74: 381-382.

McBrearty, S., and Brooks, A. S. 2000. The revolution that wasn't: a new interpretation of the origin of modern behaviour. *Journal of Human Evolution* 39: 453-563.

Meadows, M. and Baxter, A. 1999 Late Quaternary palaeoenvironments of the southwestern Cape, South Africa: a regional synthesis. Quaternary International 57/58: 193-206.

Meadows, M. and Baxter, A. 2001. Holocene vegetation history and palaeoenvironments at Klaarfontein Springs, Western Cape, South Africa. *Holocene* 11: 699-706.

Meadows, M., Baxter, A., and Parkington, J. 1996. Late Holocene environments at Verlorenvlei, Western Cape Province, South Africa. *Quaternary International* 33: 81-95.

Meehan, B. 1982. Shell bed to shell midden. Canberra: Australian institute of Aboriginal studies.

Metcalfe, D., and Jones, K, T. 1988. A reconsideration of animal body-part utility indices. *American Antiquity* 53 (3): 486-504.

Miller, D., Yates, R., Parkington, J., and Vogel, J. 1993. Radiocarbon dating evidence relating to a mid-Holocene relative high sea-level on the southwestern Cape coast, South Africa. *South African Journal of Science* 89: 35-44.

Mitchell, P. 1995. Revisiting the Robberg: new results and a new idea of old ideas at Sehonghong Rock Shelter, Lesotho. *South African Archaeological Bulletin* 50: 28-38.

Mitchell, P. 1996. Prehistoric exchange and interaction in southeastern southern Africa: marine shells and ostrich eggshell. *African Archaeological Review* 13: 35-76.

Mitchell, P. 1988. The early microlithic assemblages of southern Africa. Oxford: British International Reports

Mitchell, P. 2002. The archaeology of southern Africa. Cambridge: Cambridge University Press.

Morrison, D. 1997. Caribou Hunters in the Western Arctic: Zooarchaeology of the Rita-Claire and Bison Skull sites. Archaeological Survey of Canada Mercury Series Paper 157. Canadian Museum of Civilization.

Noe-Nygaard, N. 1975. Bone injuries caused by human weapons in Mesolithic Denmark. In Clason, A.T. (ed) Archaeozoological Studies. New York: American Elsevier Publishing Co. Inc.

O'Leary, M.H. 1995. Environmental effects on carbon isotope fractionation in terrestrial plants. In: Wada, E., Yoneyama, M. Minigawa, T. & Ando, T. (eds.) Stable isotopes in the biosphere: 78-91. Kyoto: Kyoto U.P.

Orton, J. 2002. Patterns in stone: the lithic assemblage from Dunefield Midden, Western Cape, South Africa. *South African Archaeological Bulletin* 57: 31-37.

Orton, J. 2006. The Later Stone Age lithic sequence at Elands Bay, Western Cape, South Africa: raw materials, artefacts, and sporadic change. *Southern African Humanities* 18 (2): 1-28

Orton, J. 2007. Preliminary report on excavations at four sites near Jakkalsberg in the Richtersveld, South Africa. Digging Stick *(in press)*

Orton, J. and Compton, J. 2006. A reworked mid-Holocene lithic assemblage at Dunefield Midden 1, Elands Bay, South Africa. *South African Archaeological Bulletin* 61: 90-95.

Orton, J. and Halkett, D. 2001. Mid-Holocene denticulates in the Richtersveld. *Southern African Field Archaeology* 10: 19-22.

Orton, J. and Halkett, D. 2005. A report on the archaeological mitigation program at De Beers Namaqualand mines, August to September 2004. unpublished report for De Beers Mining Co.

Orton, J., Hart, T., and Halkett, D. 2005. Shell middens in Namaqualand: two Later Stone Age sties at Rooiwalbaai, Northern Cape. *South African Archaeological Bulletin* 60 (181): 24-30

Parkington, J. 1980. Time and place: some observations on spatial and temporal patterning in the Later Stone Age sequence of southern Africa. *South African Archaeological Bulletin* 35: 73-83.

Parkington, J. 1988. The Pleistocene/Holocene transition in the Western Cape, South Africa: observations from the Verlorenvlei, In J. Bower and D. Lubell (eds.) Prehistoric cultures and environments in the late Quaternary of Africa, Oxford: British Archaeological Reports, 349-63.

Parkington, J. 1991. Approaches to dietary reconstruction in the Western Cape: Are you what you have eaten? *Journal of Archaeological Science* 18: 331-342.

Parkington, J. 1998. Resolving the past: gender in the Stone Age archaeological record of the Western cape, In S. Kent (ed.), Gender in African prehistory, pp 25-38.

Parkington, J. 2001. Mobility, seasonality and southern African hunter-gatherers. *South African Archaeological Bulletin* 56: 1-7.

Parkington, J. 2006. Shorelines, strandlopers, and shell middens. Cape Town: Creda communications.

Parkington, J. & Fisher, J. 2006. Small mammal bones on Later Stone Age sites from the Cape (South Africa): consumption and ritual events. Archaeological papers of the American Anthropological Association 16: 71-79.

Parkington, J., Poggenpoel, C., Buchanan, B., Robey, T., Manhire, A., and Sealy, J. 1988. Holocene coastal settlement patterns in the Western Cape. In G. Bailey and J. Parkington (eds.) The archaeology of prehistoric coastlines. Cambridge: Cambridge University Press.

Parkington, J., Cartwright, C. Cowling, R., Baxter, A., and Meadows, M. 2000. Palaeovegetation at the Last Glacial Maximum in the Western Cape, South Africa: wood charcoal and pollen evidence from Elands Bay Cave. *South African Journal of Science* 96: 543-546.

Parsons, I. Stone circles in the Bloubos landscape, Northern Cape. *South African Humanities* 16: 59-69.

Pate, F.D. 1994. Bone chemistry and paleodiet. *Journal of Archaeological Method and Theory* 1-2:161-209.

Paterson, W. 1790. Travels in Africa. A narrative of four journeys into the country of the Hottentots, and Caffraria, in the years 1777, 1778, 1779. 2nd edition. London: J. Johnson.

Perkins, D. and Daly, P. 1968. A hunter's village in Neolithic Turkey. *Scientific American* 219 (5): 97-106.

Plug, I. 1993. The macrofaunal remains of wild animals from Abbot's Cave and Lame Sheep Shelter, Seacow Valley, Cape. *Koedoe* 36 (1): 15-26.

Rautenbach, I.L. 1971. Ageing criteria in the Springbok, *Antidorcas Marsupialis* (Zimmermann, 1780). *Annals of the Transvaal Museum* 27 (6): 83-143.

Richards, M.P., Schulting, R.J. & Hedges, R.E.M. 2003. Sharp shift in diet at onset of Neolithic. *Nature* 425:366.

Rudner, I. 1953. Decorated ostrich eggshell and stone implements from the Upington area. *South African Archaeological Bulletin* 8: 82-84.

Rudner, J. 1968. Strandloper pottery from South and South West Africa. *Annals of the South African Museum* 49:441-663

Sadr, K. 1998. Kalahari archaeology and the Bushman debate. *Current Anthropology* 38: 104-112.

Sadr, K. 2003. The Neolithic of southern Africa. *Journal of African History* 44: 195-209.

Sadr, K. 2004. Feasting on Kasteelberg? Early herders on the west coast of South Africa. *Before Farming: the archaeology of old world hunter-gatherers* 2004/3 (2). (http://waspjournals.com)

Sadr, K., and Smith, A. B. 1991. On ceramic variation in the south-western cape, South Africa. *South African Archaeological Bulletin* 46: 107-114.

Sampson, G. 1972. The Stone Age industries of the Orange River scheme and South Africa. *Memoirs of the National Museum (Bloemfontein)* 5: 1-288.

Sampson, G., and Plug, I. 1993. Late Holocene and historical bone midden density in rock shelters of the Seacow River valley. *Southern African Field Archaeology* 2: 59-66.

Sampson, G., Hart, T., Wallsmith, D, and Blagg, J. 1989. The ceramic sequence in the upper Seacow valley: problems and implications. *South African Archaeological Bulletin*. 44: 3-16.

Savelle, J.M., Friesen, T.M., and Lyman, R.L. 1996. Derivation and application of an Otariid utility index. *Journal of Archaeological Science* 23: 705-712.

Schoeninger, M.J. & Moore, K. 1992. Bone stable isotope studies in archaeology. *Journal of World Prehistory* 6:247-296.

Schoeninger, M. & DeNiro. 1984. Nitrogen and carbon isotopic composition of bone collagen from marine and terrestrial animals. *Geochemica et Cosmochimica Acta* 48: 625-639.

Schoeninger, M., DeNiro, M., and Tauber, H. 1983. Stable isotope ratios of bone collagen reflect marine and terrestrial components of prehistoric human diet. *Science*. Vol (220) 1381-1383.

Schrire, C. 1980. An enquiry into the evolutionary status and apparent identity of San hunter-gatherers. *Human Ecology* 8:9-32.

Schwarcz, H., Melbye, J., Katzenberg, M., and Knyf, M. 1985. Stable isotopes in human skeletons of southern Ontario: reconstructing palaeodiet. *Journal of Archaeological science* 12: 187-206.

Schweitzer, F. 1979. Excavations at Die Kelders, Cape Province, South Africa: the Holocene deposits. *Annals of the South African Museum* 78: 101–233.

Scott, L., Marais, E., and Brook, G. 2004. Fossil hyrax dung and evidence of late Pleistocene and Holocene vegetation types in the Namib Desert. *Journal of Quaternary Science* 19: 829-832.

Sealy, J. 2001. Body tissue chemistry and palaeodiet. In: Brothwell, D.R. & Pollard, A.M. (eds.) Handbook of Archaeological Sciences: 269-279. London: Wiley & Sons.

Sealy, J. 2006. Diet, mobility, and settlement pattern among Holocene hunter-gatherers in southernmost Africa. *Current Anthropology*. 47: 569-595.

Sealy, J.C. & van der Merwe, N.J. 1986. Isotope assessment and the seasonal-mobility hypothesis in the southwestern Cape of South Africa. *Current Anthropology* 27(2):135-150.

Sealy, J. and van der Merwe, N. 1988. Social, spatial and chronological patterning in marine food use as determined by delta 13C measurements of Holocene human skeletons from the south-western Cape, South Africa. *World Archaeology*. 20:87-102.

Sealy, J. and van der Merwe, N. 1992. On "Approaches to dietary reconstruction in the western Cape: Are you what you have eaten?"- a reply to Parkington. *Journal of Archaeological Science* 19: 459-466.

Sealy, J. and Yates, R. 1994. The chronology of the introduction of pastoralism to the Cape, South Africa. *Antiquity* 68:58-67.

Sealy, J., van der Merwe, N.J., Thorp, J.A.L., Lanham, J. 1987. Nitrogen isotopic ecology in southern Africa: implications for environmental and dietary tracing. *Geochemica et Cosmochimica Acta* 51: 2707-2717.

Sealy, J., Pfeiffer, S., Yates, R., Wilmore, K., Manhire, A., Maggs, T., & Lanham, J. 2000. Hunter-gatherer child burials from the Pakhuis Mountains, Western Cape: growth, diet and burial practices in the Late Holocene. South African Archaeological Bulletin 55: 32-43.

Silberbauer, G. 1981. Hunter and Habitat in the central Kalahari Desert. Cambridge: Cambridge University Press.

Skinner, F. J.D., Moss, D.G., and Skinner, D. 2002. Inherent seasonality in the breeding seasons of African mammals: evidence from captive breeding. *Transactions of the Royal Society of South Africa* 57:25-34.

Skinner, J.D., Nel, J.A.J., & Millar, R.P. 1977. Evolution of time of parturition and differing litter sizes as an adaptation to changes in environmental conditions. In: Calaby, J.H., & Tyndale-Biscoe, C.H. (eds.) Reproduction and Evolution: Proceedings of the fourth symposium on comparative biology of reproduction, held in Canberra, December 1976. 39-44. Canberra: Australian Academy of Science.

Skead, C. J. 1980. Historical mammal incidence in the Cape Province vol 1: The Western and Northern Cape. Cape Town: The Department of Nature and Environmental Conservation of the Provincial Administration of the Cape of Good Hope.

Smith, A., Sadr, K., Gribble, J., and Yates, R. 1991. Excavations in the south-western Cape, South Africa, and the archaeological identity of prehistoric hunter-gatherers within the last 2000 years. *South African Archaeological Bulletin* 46:71-91.

Smith, A., Halkett, D., Hart, T., and Mutti, B. 2001. Spatial patterning, cultural identity and site integrity on open sites: evidence from Bloeddrift 23, a pre-colonial herder camp in the Richtersveld, Northern Cape Province, South Africa. *South African Archaeological Bulletin* 56: 23-33.

Smith, B. and Ouzman, S. 2004. Taking Stock: identifying Khoekhoen herder rock art in southern Africa. *Current Anthropology* 45 (4): 499-515.

Stevenson, C., Lee-Thorp, J., and Holmgren, K. 1999. A 3000-year record from a stalagmite in Cold Air Cave, Makapansgat Valley, Northern Province. *South African Journal of Science* 95: 46-48.

Stowe, G. 1905. The native races of South Africa. London: Swan Sonnenschein and Co.

Talma, S. and Vogel, J. 1993. A simplified approach to calibrating ^{14}C dates. *Radiocarbon* 35: 317-322.

Tauber, H. 1981. ^{13}C evidence for dietary habits of prehistoric man in Denmark. *Nature* 292:332-333.

Thackeray, A. 1977. Stone artefacts from Klipfonteinrand, BA (Hons.) thesis, University of Cape Town.

Tonner, T. 2005. Later Stone Age shellfishing behaviour at Dunefield Midden (Western Cape, South Africa). *Journal of Archaeological Science* 32: 1390-1407.

Tribolo, C., Mercier, N., Selo, M., Joron, J-L, Reyss, J-L, Henshilwood, C., Sealy, J., and Yates, R. 2006. TL dating of burnt lithics from Blombos Cave (South Africa): further evidence for the antiquity of modern human behaviour. *Archaeometry* 48 (2): 341-357.

Tyson, P. 1986. Climatic change and variability in Southern Africa. Cape Town: Oxford University Press.

Tyson, P. and Lindesay, J. 1992. The climate of the last 2000 years in southern Africa. *The Holocene* 2,3: 271-276.

Tyson, P. D., Karlen, W., Holmgren, K. & Heiss, G. A. 2000. The Little Ice Age and medieval warming in South Africa. *South African Journal of Science* 96: 121-126.

Villa, P. and Mahieu, E. 1991. Breakage patterns of human long bones. *Journal of Human Evolution* 21: 27-48.

Vogel, J., Plug, I., and Webley, L. 1997. New dates for the introduction of sheep into South Africa: the evidence from Spoegrivier Cave in Namaqualand. *South African Journal of Science* 93: 246-248.

Wadley, L. 1987. Later Stone Age hunters and gatherers of the southern Transvaal: social and ecological interpretation. Cambridge monographs in African Archaeology 25. British Archaeological Report International series 380.

Wadley, L. 1996. The Robberg industry of Rose Cottage Cave, eastern Free State: the technology, spatial patterns and environment. *South African Archaeological Bulletin* 51:64-74.

Wadley, L. 1997. Rose Cottage Cave: archaeological work from 1987 to 1997. *South African Journal of Science* 93: 439-444.

Wadley, L. 1998. The invisible meat providers: women in the stone age of South Africa, In S. Kent (ed.) Gender in African prehistory, pp. 69-82.

Wadley, L. 2000. The early Holocene layers of Rose Cottage Cave, eastern Free State: technology, spatial patterns, and environment. *South African Archaeological Bulletin* 55: 18-31.

Webley, L. 1984. Archaeology and ethnoarchaeology in the Leleifonein reserve and surrounds, Namaqualand. unpublished Masters thesis. University of Stellenbosch.

Webley, L. 1992. The history and archaeology of pastoralist and hunter-gatherer settlement in the North-western Cape. unpublished PhD thesis. University of Cape Town.

Webley, L. 1997. Jakkalsberg A and B: the cultural material from two pastoralist sites in the Richtersveld, Northern Cape. *Southern African Field Archaeology* 6: 3-19.

Webley, L. 2002. The re-excavation of Spoegrivier cave on the west coast of South Africa. *Annals of the Eastern Cape Museums* 2:19-49.

Webley, L., Archer, F., and Brink, J. 1993. Die Toon: a Late Holocene site in the Richtersveld National Park, Northern Cape. *Koedoe* 36 (2): 1-9.

Weissner, P. 1982. Risk, reciprocity, and social influence on !Kung San economics. In E. Leacock & R. Lee (eds.) Politics and history in band societies 61-84. Cambridge: CUP.

Wendt, W. 1972. Preliminary report on an archaeological research programme in South West Africa. *Cimbebasia* 2:1-59.

Woodborne, S., Hart, K., and Parkington, J. 1995. Seal bones as indicators of the timing and duration of hunter-gather coastal visits. *Journal of Archaeological Science* 22: 727-740.

Woodburn, J. 1982. Egalitarian societies. *Man* 17: 341-451.