CHAPTER 6

DISCUSSION

6.1 Introduction

The central focus of this study was on reconstructing the palaeoenvironment of the southern Cape during the Later Stone Age and Middle Stone Age occupations at Blombos Cave (BBC). The intention was to link a speleothem derived stable isotope record to the dated occupations at BBC (*e.g.* Jacobs *et al.* 2006; Tribolo *et al.* 2006; see Chapter 3). Using this approach, the aim was to establish whether climate change influenced human behaviour (*e.g.* subsistence strategies, settlement patterns & material culture production) during the MSA occupations at the site.

Within this investigative framework, speleothems were collected from several caves located within the De Hoop Nature Reserve, which is approximately 30 km east of BBC. Given the close proximity of the site to the reserve, shared environmental conditions and geology, the De Hoop speleothem samples were considered suitable palaeoenvironmental proxies for BBC. The speleothem sampling approach, detailed methodology and results from the uranium series dating and stable isotope analyses were presented in Chapter 4 and Chapter 5, respectively. As discussed in Chapter 4, palaeovegetation change in the region was determined from the carbon isotope signal with the corresponding oxygen isotope values related to palaeoprecipitation.

The De Hoop speleothem record covers two distinct intervals. The first interval is represented by the Bloukrantz Cave sample (*Blou1*) and provides a discontinuous record from c. 48-46 ka with an observed break in deposition until c. 3.5 ka. The second interval of speleothem growth is denoted by the Kaisers Gat II sample (*KG2.3*) and age estimates for this sample appear to fall within the c. 100-115 ka range. These caves are located along the coast and are c. 8 km apart.

This chapter comprises four main sections and summarises the results of the study within a broader environmental context by comparing the speleothem-based isotope records with other Quaternary proxy data. The first section relates the isotopic changes identified in the Bloukrantz and Kaisers Gat II records to the Antarctic ice core (*viz.* Dome F) and the MD962077 sediment core. The latter sediment core, located along South Africa's east coast (33.17°S, 31.25°E at a depth of 3781 m), falls within the Indian Ocean Agulhas Current and provides a record of sea surface temperature (SST) changes (Bard & Rickaby 2009). In the second section, the likely forcing mechanisms associated with the climatic variations expressed in the Bloukrantz Cave and Kaisers Gat II speleothem records are explored. The third section focuses on the MSA occupations at BBC and explores the De Hoop stable isotope chronology within this archaeological context.

6.2 Comparison of the De Hoop palaeoenvironmental evidence with other terrestrial proxy records

(Figs 6.1a, b, 6.2a, b & 6.3)

As discussed in Chapters 4 and 5, the speleothem-based isotope records used in this study were used as proxies for vegetation and precipitation changes. The Bloukrantz Cave stalagmite, denoted as *Blou1* is dated from c. 3.5 to 50 ka with the Kaisers Gat II sample, *KG2.3* dated between 100 and c. 115 ka. The *Blou1* record covers part of MIS 3 between c. 46-48 ka with a hiatus from c. 45 ka until the late Holocene c. 3.5 ka. The data for the *KG.2.3* record is correlated with MIS 5c/d.

Presently, there are no published high resolution proxy records from the southern Cape spanning the interval of the *KG2.3* sample. The only record that spans this interval comes from the Tswaing Impact Crater in South Africa's summer rainfall zone. It provides a 200 kyr record of rainfall changes in southern Africa (*e.g.* Partridge *et al.* 1993, 1997; Kristen *et al.* 2007). Unfortunately, this record is considered an unsuitable analogue for the southern Cape coast (*e.g.* Chase & Meadows 2007; Chase 2010). An interpretation of the *KG2.3* isotope data is therefore limited to comparisons with data from archaeological and sedimentary contexts. A comparison of the isotope data from Bloukrantz Cave and Kaisers Gat II (denoted, respectively as *Blou1 & KG2.3*) exhibited broad synchronicity with the Dome F (Fig. 6.1a, b) and the Agulhas Current sea surface temperature (SST) records (Fig. 6.2 a, b).



Figure 6.1 (a, b) Comparison between the Dome F δ^{18} O record and the De Hoop isotope data from *Blou1* and *KG2.3*. The *KG2.3* isotope data has not been interpolated and the isotope values does not represent an age-interpolation The Dome F isotope data was obtained from ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/domefuji/df-d18o-340ka-dfo2006.txt, Kawamura *et al.* 2007)



Figure 6.2(a, b) Palaeovegetation data obtained from the δ^{13} C signal in *Blou1* and *KG2.3* compared with the Indian Ocean sea surface temperatures (SSTs) from the MD962077 sediment core. (The data corresponding to MD962077 was obtained from Bard and Rickaby (2009) at

http://www.nature.com/nature/journal/v460/n7253/suppinfo/nature08189.html)

The δ^{13} C data tracked the SSTs recorded in the MD962077 core with C₃ vegetation types correlated with cooler SSTs and C₄/CAM growth forms coinciding with warmer SSTs (Fig. 6.2a, b). The δ^{18} O data was broadly congruent with the δ^{18} O record of the Dome F ice core. Lower δ^{18} O values recorded in the *Blou1* stalagmite generally followed cooler periods in the ice core with warmer periods in the Dome F record coinciding with higher δ^{18} O values in *Blou1* and *KG2.3* (Fig. 6.1a, b). The intervals of cooler and warmer climatic conditions in the Antarctica record were also congruent with colder and warmer SSTs from the MD962077 sediment core (Fig. 6.3). Collectively, these correlations indicate that the isotopic signal preserved in the *Blou1* and *KG2.3* stalagmites was climatically determined. The two distinct periods of environmental change identified from the De Hoop speleothem record (*viz.* Mid-MIS 3 & MIS 5c/d) is considered separately.



Figure 6.3 δ^{18} O signal in the Dome F ice core compared with the Indian Ocean temperatures recorded in MD962077 (The data for the Dome F ice core was obtained from

<u>ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/domefuji/df-d18o-340ka-dfo2006.txt</u>, Kawamura *et al.* 2007 & the data for MD962077 was obtained from Bard and Rickaby (2009) at

http://www.nature.com/nature/journal/v460/n7253/suppinfo/nature08189.html)

6.2.1 Mid-MIS 3

In the Bloul record the U-series dated interval from c. 50-46 ka was characterised by generally high δ^{18} O and δ^{13} C values. These values displayed broad synchronicity with a transition towards interstadial conditions in the Dome F ice core and mild to moderate although low SSTs in the MD962077 sediment core. Based on the δ^{18} O values it appears that the *Blou1* stalagmite formed during the warmer part of MIS 3 when interstadial conditions were generally more humid and conducive for carbonate precipitation. The termination of stalagmite growth c. 45 ka indicates that although the De Hoop region would have received more seasonal (possibly winter rainfall) by c. 45 ka, conditions above the cave could have been cooler and possibly drier than during MIS 5. The onset of cooler conditions observed in the *Blou1* chronology c. 45 ka coincides with an episode of lunette accretion reported on the Agulhas Plain (Carr et al. 2006b). Periods of lunette formation are thought to reflect stronger westerly wind activity and a concomitant reduction in moisture derived from the warm Agulhas Current (Carr et al. 2006b). Similar evidence for cold and dry conditions from c. 60-55 ka comes from the charcoal in Boomplaas Cave (Scholtz 1986) and the increased grazing fauna at Die Kelders Cave (Klein 1976; Klein & Cruz-Uribe 2000). Evidence for relatively moist conditions during some parts of MIS 3 also comes from pollen data in the Voëlvlei sediment core between c. 48-33 ka BP (Carr et al. 2006b; Mitchell 2008). Cooler and moisture conditions are also reported at Diepkloof Rock Shelter between c.65-55 ka (Texier et al. 2010).

A contemporaneous record of cooler and drier conditions *c*. 51 ka also comes from the Wolkberg Cave stalagmite (Holzkämper *et al.* 2009), where a shift to aragonite deposition coincided with an interval of reduced precipitation recorded in the Tswaing Impact Crater (*i.e.* Pretoria Saltpan) (Partridge 1997; Kristen *et al.* 2007).

Overall, the *Blou1* record indicates that the interval from *c*. 50-46 ka, which falls within mid-MIS 3, was characterised by an increased dominance of C_4 /CAM vegetation and generally warm conditions with possibly, more effective summer precipitation.

6.2.2 MIS 5c/d

The KG2.3 chronology covers the periods between *c*. 100-115 ka and appears to fall within MIS 5c/d. Owing to the paucity of high resolution records in southern Africa, particularly from the southern Cape, contemporaneous palaeoclimatic data comes primarily from other regional proxies.

Based on the *KG2.3* δ^{13} C data, it appears that vegetation between MIS 5c/d was characterised by a mosaic of C₄/CAM and C₃ growth forms. Since this interpretation is based on variations around an average δ^{13} C value of -9.1 ‰ (see Chapter 4 for details), it is possible that vegetation may have shifted between C₄, CAM and C₃ types from *c*. 100-115 ka. The corresponding δ^{18} O signal is well within the range of warm rainfall reported in stalagmite records at several South African sites (*viz*. Crevice Cave & Cold Air Cave) (see Chapter 5 for details).

Contemporaneous data for generally wet conditions with a shift between open and closed (forested) vegetation throughout MIS 5 was also inferred from the diversity of rodent microfauna at Klasies River (Avery 1987). Wetter conditions than present with woodland vegetation was also reported at Still Bay where fossil footprints of *Loxodonta africana* (Cape elephant) were found in aeolianites dated to *c*. 90 ka (Roberts *et al.* 2008). It has also been proposed that during periods of warmer and wetter environmental conditions, mountain fynbos, subtropical thicket and Afromontane forest would have expanded across the Cape coast (Cowling 1983).

Coinciding with the environmental conditions inferred from the KG2.3 data are several episodes of cordon dune and aeolianite formation that are reported from Wilderness and Hoë Walle (Bateman *et al.* 2004; Carr *et al.* 2007). These periods of aeolian deposition have been related to eustatic sea level transgression when the southern Cape coast would have been within 2 km of the shore (Carr *et al.* 2007; Fisher *et al.* 2010). At Cape Agulhas, a sea level of *c.* 7.5 m asl, which occurred between *c.* 125-111 ka, is thought to reflect a shift from the present-day rocky shoreline to a sandy shoreline (Carr *et al.* 2010). At Klasies River, shellfish data from the c. 106.8 ± 12.6 ka LBS member (Feathers 2002), indicates an increase in the marine shell concentration of warm water *Perna perna* (brown mussel) and *Turbo sarmaticus* (Turban shell) (Thackeray 1988, 2007), which is broadly coeval with interpretations that during interglacial periods the site was in close proximity to the sea. The higher density of shellfish from the contemporaneous c. 100 ka M3 occupation level at Blombos Cave also suggests a higher sea level (e.g. Henshilwood 2008a; Henshilwood et al. 2001a; see Chapter 3 for further details). The presence of cold water *Patella* granatina (granite limpet) and *Choromytilus meridionalis* (black mussel) in the M3 level suggests that although interglacial (interstadial) water temperatures were warmer, suitable microhabitats with cooler temperatures may have existed (e.g. Mitchell 2008).

Overall, the *KG2.3* data indicates that environmental conditions may have been generally warm and wet throughout the interval when the stalagmite formed. Both the δ^{13} C and δ^{18} O values correlate with an interval of warming in the Dome F core (Fig. 6.1b) and warmer (> 23 °C) Indian Ocean SSTs in the MD962077 core (Fig. 6.2b).

6.3 Forcing mechanisms of environmental change documented in the De Hoop speleothem records

During the Pleistocene the global climate was largely modulated by orbital forcing. These forcing mechanisms, which are known as Milankovitch cycles, are related to shifts in the Earth's rotational axis and are represented by three parameters; eccentricity, precession and obliquity. Eccentricity refers to variations in the shape of the earth's orbit, which changes from circular to more elliptical motion over 125 and 96 ka cycles (Maslin & Christensen 2007). Obliquity is related to the Earth's tilt along its rotational axis with changes between 22 and 25° over 41 ka cycles. Precession varies over *c*. 23 ka cycles and is associated with the gyrating motion of the rotational axis and elliptical orbit (Maslin & Christensen 2007). Collectively, variations in each of these orbital parameters have a significant impact on the amount and distribution of solar radiation entering the

Earth's atmosphere. A direct consequence of these insolation-regulating effects is the asynchronous climatic response between the northern and summer hemispheres (*e.g.* Barker & Knorr 2007). In the South African context, summer rainfall has been shown to respond strongly to changes in orbital precession (Partridge 1993, 1997; Partridge *et al.* 1997; Kristen *et al.* 2007). This interpretation is based primarily on an analysis of the sediments in the Tswaing Impact Crater (*i.e.* Pretoria Saltpan), which are used as a rainfall proxy. More than 44 % of the rainfall variation identified in this 200 ka long crater was attributed to precessional changes (Partridge *et al.* 1997).

In recent years, it has been argued that precessional changes only account for some of the climatic variation expressed across South Africa and in the context of this study, changes in the main components of the oceanic and atmospheric circulation system thought to contribute more strongly to the regional palaeoclimatic record (*e.g.* Partridge 1993, 1997; Chase 2010; see Chapter 2).

As discussed in Chapter 2, the ocean-atmosphere interactions in the southern Cape are influenced primarily by the exchange of water between the Indian and Atlantic Ocean, the westerly and tropical easterly winds. The westerlies generate the winter storm tracks over the region while the easterlies contribute to summer rainfall (Tyson & Preston-Whyte 2000). Changes in the relative influence of these factors along the southern Cape coast have been coeval with shifts in the orientation of the Subtropical Convergence (STC) (e.g. Peeters et al. 2004; Bard & Rickaby 2009). It has been argued that the position of the STC shifted in response to oscillating glacial-interglacial cycles, which were in turn influenced by precessional and obliquity changes (Peeters *et al.* 2004). Shifts in the position of the STC have been determined from planktonic foraminifera identified in several sediment cores located in the southern Cape Basin (GeoB36032 & MD962081). An analysis of the foraminifera deposits, known as Agulhas leakage fauna (ALF), indicated that glacial periods were associated with a reduction in Agulhas leakage. This decline in ALF was attributed to weaker communication between the Indian and Atlantic Oceans as the STC shifted northward (Peeters et

al. 2004). Cooler sea surface temperatures (SSTs) are coeval with the reduced ALF.

Interglacial periods by contrast are related to enhanced Agulhas leakage as the STC moved southward. Warmer SSTs coincided with this shift and resulted in increased advection of moisture from the warm Agulhas Current (Reason 2002). Concomitant with fluxes in the STC and SSTs are changes in the intensity of the westerly and easterly winds. During interglacial periods, the westerly winds are thought to have shifted polewards (Van Zinderen Bakker 1976; Cockcroft *et al.* 1987). This consequently decreased the influence of the westerlies over the southern Cape while the extra-tropical cyclones were enhanced (Reason 2002; Chase 2010). These conditions are thought to have been reversed under glacial conditions.

Based on the De Hoop record, it appears that glacial (& possibly stadial) periods could have been characterised by cool conditions with more winter rainfall. However, based on the hiatus identified in the *Blou1* record from *c*. 45 ka until the late Holocene (*c*. 3.5 ka) it appears that the overall environment in the region during these colder periods may have been drier than in MIS 5. Although there is no corresponding δ^{13} C and δ^{18} O data associated with either the Last Glacial Maximum or the Pleistocene-Holocene transition, there is strong possibility that during glacial periods C₃ vegetation was prevalent throughout the De Hoop region.

During interglacial and interstadial periods by contrast, when the *KG2.3* stalagmite formed, conditions at De Hoop appear to have been warmer and wetter than in mid-MIS 3. Concomitant with this is an increase in Indian Ocean sea surface temperatures (SSTs) and Agulhas leakage fauna (ALF) as well as a southward shift in the position of the Subtropical Convergence (STC). Based on the δ^{13} C data from Kaisers Gat II it appears that both C₄, CAM and C₃ plant types may have been present.

However, based on the pattern identified in the Crevice Cave stalagmite chronology, Bar-Matthews *et al.* (2010) propose that C_4 grasses, grassy fynbos

and thicket vegetation expanded across the southern Cape coast during glacial times. Lowered atmospheric CO_2 levels are thought to have favoured the growth of these C_4 plant types (Bar-Matthews *et al.* 2010).

Based on the broad trends identified in the *KG2.3* data, it appears that C₄/CAM vegetation elements may have expanded during interglacial periods and not glacial periods as suggested from the Crevice Cave data. In the context of the De Hoop data it appears that the growth of C₄/CAM plants could have been favoured during warmer periods with a stronger summer rainfall component, as C4 plants are generally more efficient at using carbon during the summer growing season when temperatures are typically > 23 °C (Vogel *et al.* 1978; Pearcy & Ehleringer 1987 also Scott 2002). Further investigation is however needed to confirm this interpretation.

Overall, it appears that the pattern observed in the De Hoop stable isotope chronology is broadly congruent with the changes documented for the climatic variables mentioned above (*viz.* STC & SSTs). This implies that the mechanisms driving the global climate determined the changes identified in the De Hoop chronology. Table 6.1 summarises the De Hoop speleothem-based isotope chronology within the ambit of the fluctuations recorded for the STC, Indian Ocean SSTs (from MD962077) and westerly winds.

		1	<u> </u>		1	, ,	<u> </u>		
Age	Marine	$\delta^{13}C$	$\delta^{18}O$	Vegetation	Seasonal	Westerly	Relative	SST ^d	Global climate
(ka)	Isotope	(‰	(‰	signal	rainfall	wind	position		during
	Stage	V-PDB)	V-PDB)		signal ^a	intensity ^b	of the		speleothem
	(MIS)				_		STC ^c		growth
<i>c</i> . 50-46	3 (mid)	-5.5 to -1	-3 to -	Weak C_3 &	Weaker	Weaker	North to	Cool to	Cold with
			1.5	stronger	winter &		South	Moderate	warm
				C ₄ /CAM	stronger		transition		oscillations.
					summer				Carbonate
							~		deposition
									during warm
									interstadial
<i>c</i> . 115-100	5c/d	-10.5 to -	-3.5 to -	Mosaic of	Unclear	Unclear but	South	Moderate	Interglacial
		7.5	1.5	C ₃ &	but	perhaps			with stadial
				C ₄ /CAM	possibly	weak			and
					bimodal	westerly &			interstadial
					or with	increased			conditions.
					more	tropical			Stalagmite
				·	persistent	easterlies			growth during
					rainfall				warm
									interstadial

Table 6.1 Summary of the De Hoop stable isotope data from Bloukrantz Cave and Kaisers Gat II and the associated changes documented for the Subtropical Convergence (STC), sea water temperatures (SST) and inferred global climate

a = rainfall signal within δ^{18} O range from Crevice Cave (Bar-Matthews *et al.* 2010), see Chapter 5 for details

b = W ind intensity inferred from Chase (2010) and Stuut *et al.* (2002)

c = Shifts in the position of the Subtropical Convergence obtained from Peeters *et al.* (2004)

d = Sea surface temperatures sourced from MD962077 (Bard & Rickaby 2009)

6.4 Environmental conditions during the levels of MSA occupation at Blombos Cave

6.4.1 Introduction

As mentioned previously, the focus of this study was to reconstruct the palaeoenvironment of the southern Cape using a speleothem-based stable isotope chronology (Chapter 1). The intention was to link the speleothem dates with the dated occupations at Blombos Cave and consequently answer three main questions:

1. Do climate proxies from the speleothems support other palaeoclimate records for the region?

2. Do peaks and dips in speleothem growth coincide with variations in the periods of occupation at Blombos Cave?

3. What implications does this have for issues of human behavioural development (*e.g.* subsistence strategies, mobility, *etc.*) during the period identified from the speleothem record?

Do climate proxies from the speleothems support other palaeoclimate records for the region?

Overall, the speleothem data presented in this study supports the evidence from other regional proxies (discussed in Chapter 2). This is apparent from the broad synchronicity observed between the De Hoop stable isotope chronology, the Indian Ocean sea surface temperature data, sedimentary records and archaeofaunal evidence from several southern Cape sites (*e.g.* Die Kelders, Klasies River & Blombos Cave).

Do peaks and dips in speleothem growth coincide with variations in the periods of occupation at Blombos Cave?

The Bloukrantz Cave sample is dated from c. 3.5-50 ka but unfortunately, it does not cover the c. 2 ka BP Later Stone Age occupation at Blombos Cave (see Chapter 4). Neither the Kaisers Gat II nor the Bloukrantz samples cover the Still Bay occupations (M1 & upper M2) at Blombos. It is therefore not possible to determine the broad patterns of vegetation and rainfall change at Blombos during the Still Bay period. The Kaisers Gat II sample, which is dated between *c*. 100-115 ka, does however coincide with the M3 level of Middle Stone Age habitation at Blombos Cave (see Chapter 3 & 4 for details).

What implications does this have for issues of human behavioural development (*e.g.* subsistence strategies, mobility, *etc.*) during the period identified from the speleothem record?

To answer this question, the climatic data (*i.e.* stalagmite record, fauna, vegetation, shellfish & sea level proxies) correlated with the M3 occupation phase and the related material culture (*i.e.* tools & engraved ochres) is explored in section 6.4.2 below.

6.4.2 Environment and archaeology of the c. 100 ka M3 occupation at Blombos Cave

The M3 phase represents the earliest occupation at the site, contains one of the densest occupation units and includes shellfish, fish, terrestrial faunal remains, as well as *in situ* hearths and ash deposits (*e.g.* Henshilwood 2008a; Henshilwood *et al.* 2001a; see Chapter 4 for details). Human remains in the form of deciduous and permanent teeth were also identified in the M3 layers and fall within the range of anatomically modern humans (Grine *et al.* 2000; Henshilwood *et al.* 2001a; Grine & Henshilwood 2002; see Chapter 3 for details).

The data obtained from the *KG2.3* stalagmite record indicates that the M3 occupation occurred during an interval of generally warmer conditions (than during mid-MIS 3) with higher SSTs and possibly enhanced easterly flow. During this period, vegetation in the De Hoop area comprised a mosaic of C₄/CAM and C₃ plants (see Chapter 5 for details). This interpretation is coeval with the mixture of grazing and browsing fauna identified within the M3 layers (see Chapter 3 for details). Grazer species include *Equus capensis* (extinct Cape zebra/horse), the extinct Renosterveld endemic, *Hippotragus leucophaeus* (Blue antelope) (Cowling & Richardson 1995), *Connochaetes gnou* (black wildebeest) and

Syncerus caffer (African buffalo). Amongst others, the mixed feeder, *Diceros bicornis* (black rhinoceros), *Oreotragus oreotragus* (Grysbok) and *Taurotragus oryx* (eland), represents the browsers.

Further support for the prevalence of a mixed habitat in the southern Cape during MIS 5 comes from Klasies River Mouth. At this site, the LBS stratigraphic member, which represents the MSA I lithic sub-stage (Singer & Wymer 1982; Wurz 2000) falls within the range from *c*. 110-115 ka (Bada & Deems 1975; Vogel 2001; Feathers 2002). The terrestrial fauna associated with this member comprises a mosaic of extralimital antelope such as *C. gnou, Antidorcas marsupialis* (springbok) and *Redunca arundinum* (southern reedbuck) (Klein & Cruz-Uribe 2000). Collectively, the MSA I fauna and rodent micromammal data suggests a diversity of Afromontane forest, grass and fynbos vegetation elements (Klein 1974; Avery 1987). These animals were likely drawn to the coast by the diverse vegetation and fresh water, the latter of which is inferred from the presence of *R. arundinum* and *Hippopotamus amphibius* (river hippopotamus) (Henshilwood 1995, 2008b).

In addition to exploiting various terrestrial animals, people at Blombos and Klasies River also utilised coastal resources in the form of shellfish and fish. This is evident from the high density ($c. 65 \text{ kg/m}^3$) of shell recovered from the M3 phase at Blombos (see Chapter 3 for details) and the increased concentration of marine shell found in the LBS midden deposit at Klasies (*e.g.* Thackeray 1988, 2007). Coeval with the intensive exploitation of marine resources is the close proximity (c. 2-5 km) of both Blombos and Klasies to the sea (*e.g.* Thackeray 1988, 2007; Fisher *et al.* 2010).

The lithic technology associated with the subsistence activities during the M3 phase is characterised by the production of blades and flakes (Henshilwood *et al.* 2001a,b). This occupation phase does not contain any bifacial points or bone tools such as those found in the Still Bay levels (M1 & upper M2) at Blombos (see Chapter 3 & 4 for details). The M3 tools are typologically similar to the lithics produced during the MSA II (Mossel Bay) sub-stage at Klasies, which is associated with convergent Levallois-type technology (Wurz 2000; Henshilwood

et al. 2001a,b). Although no retouched points were recovered within the M3 layers, signs of impact use identified on convergent (quartz) flakes are thought to reflect their use as tips for hunting weapons (Lombard 2007). This is broadly consistent with the faunal data that indicates people were hunting relatively large (class 3 & 4) animals during the M3 occupation at Blombos. At Klasies, the lithics from the contemporaneous MSA I sub-stage comprises long quartzite blades (> 100 mm), which are considered to be similar to the Howiesons Poort bladelets (Wurz 2000; Wurz *et al.* 2003).

As discussed in Chapter 3, it has been argued that the Still Bay bifacial points, Howiesons Poort microlithic tools, as well as the bone points and awls were produced as a response to resource intensification (*e.g.* Deacon 1989). It was proposed that foragers tend to utilise a more specialised toolkit when there is an increase in competition (*e.g.* between different groups) or a decline in preferred food items (*e.g.* Henshilwood & Marean 2003). Within this context of resource intensification, which may or may not have been triggered by changing environmental conditions, aspects of symbolically mediated behaviour supposedly emerged (*e.g.* Wadley 2001; Henshilwood & Marean 2003; McCall 2007; Henshilwood 2008b *cf.* Jacobs *et al.* 2008).

In the archaeological record, definitive evidence for the expression of this "fully symbolic *sapiens* behaviour" (Henshilwood & Marean 2003: 644) comes from the use of personal ornaments (*e.g.* shell beads) and engravings, such as those recognised on the Blombos ochres and the Diepkloof ostrich eggshell (Wadley 2001; Henshilwood & Dubreuil in press).

However, some researchers disagree with this and advocate for a prolonged lag between the evolution of anatomical modernity and the development of symbolically mediated behaviour (*e.g.* Klein 1995). Based on this view, humans only became cognitively modern within the last 50 kyr. Others by contrast, argue for the progressive development of 'modern' behaviour throughout the Middle Stone Age (*e.g.* McBrearty & Brooks 2000; Henshilwood & Marean 2003). Henshilwood and Dubreuil (in press) argue that level-2 perspective taking and theory of mind are the main cognitive abilities needed to transform an object into a symbol. Within this theoretical framework, they suggest that by *c*. 77 ka symbolic communication (expressed through the Blombos ochres & shell beads) and by extension language, influenced various aspects of social life.

Incised ochre pieces comprising, (arguably) several different designs were recently identified within the c. 100 ka M3 layers (Henshilwood *et al.* 2009). The presence of these ochres, coupled with the Henshilwood and Dubreuil (in press) observations, implies (somewhat superficially at this stage) that anatomical and behavioural modernity may have emerged in conjunction with each other (*e.g.* Henshilwood & Marean 2003).

Evidence for personal ornaments, particularly shell beads, provides compelling support for self-awareness and is considered a symbolic expression of identity (*e.g.* Henshilwood & Marean 2003; Henshilwood & Dubreuil 2009, in press). Although shell beads have not been identified within the M3 layers at Blombos, they have been found within similar-aged layers at sites in the Levant. This includes Es-Skhul where *Nassarius* shell beads were found in layers dated by uranium series and electron-spin resonance techniques between *c.* 100-90 ka (Vanhaeren *et al.* 2006). Perforated and ochre stained *Glycymeris* valves were also found in a burial context at Qafzeh Cave in layers dated between *c.* 92-82.4 ka (Bar-Yosef Mayer *et al.* 2009).-Additional evidence for shell bead making also comes from the Moroccan rock shelter of Grottes des Pigeons where perforated *Nassarius* gibbosulus shells were found within stratigraphic levels dated by luminescence and uranium series methods to *c.* 82 ka (Bouzouggar *et al.* 2007).

Collectively, this data suggests that symbolically mediated aspects of human behaviour may not have been restricted to the Howiesons Poort and Still Bay in South Africa. It is however, still unclear what role if any, environmental change events may have had on the makers of the Still Bay and Howiesons Poort.

Nevertheless, based on proxy data from De Hoop, Blombos Cave and Klasies River, it appears that between *c*. 100-115 ka, both animals and people were drawn to the highly productive habitats in the vicinity of these sites (see 6.3). Overall, environmental conditions appeared to have been warm and wet with a mosaic of vegetation types and a diversity of terrestrial fauna.

The high intensity deposits associated with the c. 100 ka M3 occupation phase at Blombos, coupled with generally productive habitat conditions, could suggest that larger groups of people were occupying the coastal areas of the southern Cape at this time. It may have been possible that c. 100 ka people at Blombos used ochre as a marker of group identity, either for body decoration or on hides (e.g. Henshilwood et al. 2009) to distinguish themselves from other foragers living at the coast.

In this context, it appears that aspects of social life and to a lesser extent environmental conditions may have influenced the makers of the Still Bay at Blombos Cave.