ABSTRACT

Cultural traditions are capable of sensitive adaptations to ecological change and local environment. This may have been the case especially at the start of the Still Bay period in the Western Cape at ~77 ka ago and in a subsequent phase, the Howieson’s Poort, after ~65–50 ka ago. This paper examines the role that climatic and ecological change may have had in spurring changes in modern human behaviour during the Late Pleistocene in the Western Cape. It was relatively warm in the Cape after about ~80 ka ago and moisture levels were higher than during the Late Holocene. The nearby coastlines provided a rich source of marine food as did the terrestrial plains, and ecological circumstances were probably conducive to population growth. Is it coincidental that the ~77–72 ka old Still Bay phase of the Middle Stone Age (MSA), known for material culture that signifies modern cognitive behaviour, fits within, and may have been driven by, a period of rapid climatic deterioration in the Western Cape? Ultimately, climatic change may also have been a prominent factor in the demise of this innovative phase of the MSA. Several millennia could separate the Howieson’s Poort and the Still Bay but further precision of age estimates is required to substantiate this claim. An age estimate of ~65 ka ago for the start of the Howieson’s Poort is reasonable and this coincides with a very cold period during the Last Glacial. The cultural complexity of the Howieson’s Poort, considered ‘precocious’ by some, may also have been driven by intensification of adverse climatic conditions. A return, after ~50 ka ago, to a lithic technology characteristic of the much earlier MSA II ( ~90–80 ka ago) marks the demise of the Howieson’s Poort and it is followed by a reduction in the number of archaeological sites and a probable rapid decrease in the human population of the Western Cape. Human behaviour is clearly modified by environmental change, both in the present and in the past, and there are many examples that illustrate this link in recent times. Extending this intimate relationship to beyond 50 ka ago is more tenuous and the evidence is mostly fragmentary. This research approach has been hampered mainly by a lack of refinement concerning precise dating of climatic events in the Late Pleistocene in Africa and of the palaeoclimatic variations that occurred on a millenial scale or greater. Over the past decade and beyond, concentrated efforts by archaeologists, climatologists, geographers and environmental scientists have been contributing to a fine-tuning of the climatic variations in southern Africa after the end of the previous interglacial. Together with recent improvements in archaeologically-related dating techniques it has provided the potential for archaeologists to relate their site data, in some cases even individually-dated depositional levels, to particular climatic conditions during past stadials or interstadials in the Late Pleistocene. In this paper I examine whether there is a discernible relationship between climatic conditions and human behaviour during two extraordinary periods of the southern African MSA, the Still Bay and the Howieson’s Poort.

Keywords: Palaeoenvironments, symbolic artefacts, Still Bay, Howieson’s Poort, Western Cape Province.
mined by the technology available, but the technology does not alter the adverse conditions. Hence, the less sophisticated a technology, the fewer humans are likely to be able to survive in a marginal environment.

A further cautionary note is that even during periods of climatic deterioration humans may not move out of an affected area unless they are relatively certain that another area or region will provide better conditions. Previous knowledge of other regions, if available, may be a crucial deciding factor. Climatic deterioration or amelioration during the lifetime of individuals within a single hunter-gatherer group may be barely perceivable and the spatial boundaries of that group may remain more or less fixed over several generations. Even rapid changes, for example, in precipitation or sea-levels on a centennial or even decadal scale, may have resulted in only minor adaptations to a group’s subsistence base or technology. Gathering physical evidence that environmental variability may have affected patterns of human behaviour or technology in the Pleistocene presents a considerable challenge as these links may not be obvious from the archaeological record and changes in technology that can be observed by archaeologists may well not synchronize with climatic change (Deacon 1984; Deacon & Deacon 1986; Kent & Vierch 1989).

It is important that data are examined at an appropriate scale to establish the likely influence of environmental factors on human decision-making (Avery 1995: 343). Single archaeological sites are appropriate in that they provide finite depositional units that can be correlated to the actions of an individual or group. The various units within a site provide a snapshot of the activities at that site and may represent many generations of occupants. Depositional units that fall within a particular time or tradition at a site, for example the Howieson’s Poort of the MSA, may be especially useful for understanding the role the environment played in human decision making (Tankard 1976). Extended to an inter-site level this methodology can provide insights into human adaptations, settlement behaviour and climatic conditions on a regional scale and beyond.

Variations in the material culture of Homo sapiens in Africa in the Late Pleistocene indicate it was a period of rapid cultural change not previously observed in the MSA (McBrearty & Brooks 2000; Wurz 2000; Barham 2001; Wadley 2001a, 2006b, 2007; Henshilwood & Marean 2003, 2006). A key question is whether the archaeological evidence from this late phase of the MSA is indicative of a human cognitive system in the process of rapid change and, related to this question, whether a link can be made between phylogeography and climatic variation. In southern Africa two Late Pleistocene culture stratigraphic entities, or ‘techno-traditions’ (Wurz et al. 2003), the Still Bay and the Howieson’s Poort, have raised interest both locally and internationally because of their relatively early cultural complexity (see Wurz 2000; Howieson’s Poort, have raised interest both locally and inter- nationally because of their relatively early cultural complexity (McBrearty & Brooks 2000; Barham 2001; Bouzouggar et al. 2002; Henshilwood & Marean 2003, 2006; Vanhaeren et al. 2006). What might have driven the development of the innovative ideas associated with the Still Bay and Howieson’s Poort between ~77–50 ka ago and what selection criteria would have favoured their introduction? Explanations for the ascent and demise of these two spatially and temporally restricted entities are numerous and most focus on analyses of recovered materials (e.g. Anthony 1972; Henshilwood et al. 2002, 2004; d’Errico et al. 2005; Minichillo 2005; Lombard 2005a,b, 2006a,b, 2007; Wadley 2007) and in situ features such as hearths and spatial patterning (e.g. Deacon 1992, 2001; Wurz 2000; Wadley & Jacobs 2004, 2006; Minichillo 2005; Wadley 2006a).

Evolutionary theory, a field that is both complex and often deeply conflicting (Pearce 2002), has shown the potential to offer an alternative viewpoint of prehistory (e.g. Boyd & Richerson 1985; Richerson & Boyd 1998, 2000; Gabora 2001; Wadley 2001a; Alvard 2003; Wynn & Coolidge 2006; Henshilwood & Dubreuil, in press). Ecological modelling offers a different perspective on the past and has formed the focus of several investigations with some notable successes, for example the Deacon and Lancaster (1988) volume, and the reports on Klacies River (Deacon & Thackeray 1984; Deacon et al. 1986; Thackeray, J.F. 1992, 2007), Boomplaas (Deacon et al. 1984; Deacon 1989) and Sibudu (Wadley 2004). A lack of refinement concerning precise age estimates of climatic events in the Late Pleistocene in Africa and of the palaeoecological variations that occurred on a millenial scale or greater has for the most part hampered this research approach.

Over the past decade and beyond concentrated efforts by archaeologists, climatologists, geographers and environmental scientists are contributing to a fine-tuning of the climatic variations in southern Africa after the end of the previous interglacial (Marine Isotope Stage (MIS) 6/5e) (e.g. Grindley 1969; Deacon & Lancaster 1988; van Andel 1989; Thackeray, J.F. 1992, 2007; Avery 1995; Partridge 1997; Blumer & Brook 2001; Lambeck & Chappell 2001; Bateman et al. 2004; Carr et al. 2006; Schola et al. 2007; Roberts et al. 2008). An example is the IGCP 437 (International Geological Correlation Program) that examines coastal environmental change during sea-level highstands (Mastrozzauzzi et al. 2005). Refinements in palaeoclimatic data, together with recent improvements in dating techniques, for example, optically stimulated luminescence (Feathers 2002; Jacobs et al. 2006a,b,c), luminescence (Tribolo 2003, Tribolo et al. 2006), thorium-uranium (Vogel 2001), amino acid racemization (Miller et al. 1999) and electron spin resonance methods (Grün & Beaumont 2001), can provide the potential for archaeologists to relate their site data, in some cases even individually dated depositional levels, to particular climatic conditions during past stadials or interstadials in the Late Pleistocene.

This paper provides a background to the Still Bay and Howieson’s Poort techno-traditions, sites and age estimates and secondly, it attempts to fit available palaeoclimatic data, mainly from the MIS 5a–MIS 3 stages in the Western Cape Province of South Africa, to two archaeological techno-traditions that fall within these stages, the Still Bay and Howieson’s Poort. It is particularly appropriate to discuss these two techno-traditions in this volume dedicated to Lyn Wadley because excavations at Sibudu Cave in KwaZulu-Natal, led by Lyn, have recently uncovered a Still Bay unit below the Howieson’s Poort (Wadley 2007). With the exception of Paar Cave (Minichillo 2005) and Diepkloof (Rigaud et al. 2006) this is the only other known site in southern Africa that contains both these techno-traditions – and it is possibly the only known site with a Still Bay tradition in KwaZulu-Natal (but see Lombard 2007). The final discussion centres on whether, and if so, how, the Still Bay and the Howieson’s Poort techno-traditions may relate to variations in regional environmental conditions and how these observations could be extended to a regional synthesis.

BACKGROUND TO THE STILL BAY

Heese’s (n.d.) suggestion in the 1920s that the artefact that should typify the Still Bay is the ‘lance-head’ in elongated...
laurel-leaf-form, has recently been promoted again as an accurate marker of the Still Bay techno-tradition (e.g. Henshilwood et al. 2001a; Wadley 2007). For decades there was disagreement over this definition, particularly because Goodwin wished to include the ‘oak-leaf’-shaped ‘spear point’ (Goodwin & van Riet Lowe 1929: 119). Later the term Still Bay was to include numerous other lithic forms which Goodwin (1928, 1929) attributed to the ‘Middle Stone Age’. Peers (1929: 3) used Heese’s definition for the Still Bay when excavating at Peers Cave, situated on the Cape Peninsula (Fig. 1) and stated in a report that the “true Still Bay with typical laurel-leaf spear heads lay beneath the Howieson’s Poort”. Subsequent excavators at the site, Jolly (1948) and later Anthony (1963, 1967), did not agree with Peers that the Still Bay necessarily lay below the Howieson’s Poort. Because Peers Cave was the only known site to include both the Still Bay and Howieson’s Poort techno-traditions the chronological position of each remained unresolved and the fossile directeurs of the Still Bay, lanceolate bifacial points, were subsumed into the Howieson’s Poort (e.g. Malan 1955; Goodwin 1958). Sampson (1974) later questioned the validity of the term Still Bay and although it was still used by Schirmer (1975) to describe the bifaciacls excavated at Dale Rose Parlour (Fig. 1) it subsequently fell out of use. Excavations at Klasies River (Singer & Wymer 1982; Wurz 2000), Nelson Bay Cave (Volman 1981) and Paardeberg (Wurz 2000) (Fig. 1) produced bifacially flaked pieces from levels below the Howieson’s Poort, but these did not conform to the Still Bay ‘type’ suggested by Heese. By the 1980s the term Howieson’s Poort was included in a new schema for the Middle Stone Age (Singer & Wymer 1982; Volman 1984), but the Still Bay was dropped.

Still Bay lanceolate bifacial points were discovered in situ from excavations at Hollow Rock Shelter and Blombos Cave (Fig. 1) in the 1990s and in the respective site reports the name for this techno-tradition was revived (Evans 1994; Henshilwood 1995). Excavations at Blombos Cave after 1997 led to a proposal that the term Still Bay be reinstated and the statement that “Still Bay bifacial points are a distinct type restricted to the Cape. We propose ‘Still Bay sub-stage’ as a regional, culture-stratigraphic term for assemblages with fully bifacially flaked, lanceolate shaped points.” (Henshilwood et al. 2001a: 429). Excavations at two sites, Sibudu Cave in KwaZulu-Natal (Wadley 2004, 2005b; 2007; Wadley & Jacobs 2004, 2006) and Diepkloof in the Western Cape (Fig. 1) (Parkington et al. 2005; Rigaud et al. 2006) have recently uncovered Still Bay units below those of the Howieson’s Poort levels. The Still Bay unit at Sibudu is significant because it is the first ‘true’ Still Bay occurrence outside the Western Cape and, as has rarely been the case, the associated fauna is well preserved (Wadley 2007). Final age estimates for the Still Bay levels at both sites may help to clarify the important temporal and perhaps spatial relationship of the Still Bay and the Howieson’s Poort.

FIG. 1. Location of major cave or shelter sites containing Still Bay and Howieson’s Poort materials in the Western Cape Province. Abbreviations: BBC, Blombos Cave; BP, Boomplaas; DRS, Dale Rose Parlour; DRS, Diepkloof; HRS, Hollow Rock Shelter; KR, Klasies River; KL, Klipfonteinrand; MC, Montagu Cave; NBC, Nelson Bay Cave; PB, Paardeberg; PC, Peers Cave; TC, Tunnel Cave; TK, Trappieskop.

STILL BAY SITES AND MATERIAL CULTURE

The principal cave or shelter sites that contain Still Bay type artefacts are Blombos Cave (Henshilwood et al. 2001a), Dale Rose Parlour (Goodwin & Peers 1953; Schirmer 1975), Diepkloof Rock Shelter (Rigaud et al. 2006), Hollow Rock Shelter (Evans 1994), Paardeberg (Wurz 2000), Peers Cave (also known as Skildergatkop, Peers’ Shelter, B/102) (Peers 1929; Jolly 1948; Peers & Goodwin 1953; Malan 1955; Anthony 1963, 1967), Sibudu Cave (Wadley 2007), Tunnel Cave (Malan 1955) and Trappieskop (note that the Trappieskop sites include B/102, C/103 known as Nero’s Cave, and G/107 but not Dale Rose Parlour – see Goodwin and Peers (1953: 59)) (Fig. 1). Still Bay bifaciales have been recovered from open or dune sites and these include the Cape Town Dune-fields (Dale 1870); Cape Hangklip (Gatehouse 1955), Blombosch Sands (Heese n.d., 1933), Kleinjongensfontein (Heese n.d., 1933) and various sites near Wellington, Western Cape Province (Heese n.d.).

The tear-shaped points of the Pietersburg Complex (Sampson 1974) in the Free State, and the round-based bifacial
points from Umhlatuzana in KwaZulu-Natal bear similarities to the Still Bay, but their relationship to the Still Bay is unclear (Kaplan 1990; M. Lombard, pers. comm. 2007). The age estimates for the Pietersburg Complex suggest that these artefacts were being made at about the same time as those in the Still Bay (e.g. Grün & Beaumont 2001). Elsewhere in Africa the bifacial type points recovered are mostly distinctive, for example, the Aterian notched bifacial (Bouzouggar et al. 2002). The relationship of these complexes in central, east and north Africa to the Still Bay in southern Africa is not clear. A macrof不准eproject of bifacial points from Blombos shows that some were used as spear points for hunting and that others probably served also as multi-functional tools (Lombard 2007; also Minichillo 2005). Most of the recovered bifacial foliate points were made of fine-grained raw materials (Evans 1994; Henshilwood et al. 2001a; Minichillo 2005). They may also have served a symbolic role (Henshilwood et al. 2001a) and although there is no direct evidence, the predominant use of exotic raw materials for their manufacture suggests that this may have added value to these tools (cf. Wiessner 1983) that may have been exchanged items used to promote social relations (Mellars 1996).

Recovered fauna may be a useful indicator of diet, but may also suggest environmental conditions at the time a site was occupied (Klein 1980; Singer & Wymer 1982; Thackeray, J.F. 1992, 2007; Henshilwood et al. 2001a). At most known sites that contain Still Bay artefacts, fauna is not preserved. Exceptions are Blombos Cave (Henshilwood et al. 2001a), Peers Cave (Volman 1981) and Sibudu Cave (Wadley 2007). Fauna is not reported from Diepkloof (Rigaud et al. 2006), but have apparently been recovered (C. Poggenpoel, pers. comm. 2007). At Blombos shellfish and fish were consumed regularly during the Still Bay occupation and a range of terrestrial and marine animals were brought back to the cave. This subsistence pattern is no different to that in the Later Stone Age levels at the site, which suggests that the subsistence mode during the Still Bay period was essentially modern, or at least the same as in the Holocene.

Ochre is common at a number of Still Bay sites, for example, Blombos Cave (Henshilwood et al. 2001a), Dale Rose Parlour (Schirmer 1975), Diepklouf (Rigaud et al. 2006) and Hollow Rock Shelter (Evans 1994). Scraping or grinding marks are present on many and some pieces are shaped like crayons or pencils, perhaps as a result of the direct application of the ochre to an abrasive surface (Clark et al. 1984; Henshilwood et al. 2001a; Rigaud et al. 2006). Ochre is likely to have had a symbolic appearance that gave ‘added value’ and although there is no evidence for this, these polished artefacts may have functioned as high value goods that were exchanged between groups (cf. Wiessner 1983; Mellars 1996).

**DATING THE STILL BAY**

The Still Bay levels at Blombos Cave have age estimates calculated by a number of methods (Jones 2001; Jacobs et al. 2003a,b, 2006a,b,c; Tribolo 2003; Tribolo et al. 2006). The Middle Stone Age levels at the site are divided into three phases, M1, M2 and M3 (Fig. 2). Bifacial foliate points were recovered from the M1 and M2 phases. An hiatus level composed of undisturbed aeolian sand above the M1 phase has optically stimulated luminescence age estimates of 67.8 ± 4.2 ka, 69 ± 5 ka and 70 ± 5 ka (Henshilwood et al. 2002: Jacobs et al. 2003a,b, 2006a,b,c) (Fig. 2). An optically stimulated luminescence (OSL) age of 72.7 ± 3.1 ka was obtained for the upper part of the M1 phase (Jacobs et al. 2003a,b). Thermoluminescence (TL) dates for the M1 phase indicate that 74 ± 5 ka and 78 ± 6 ka are the likely ages for these Still Bay levels (Tribolo et al. 2006). The M2 phase also contains Still Bay bifacial, although in lower frequencies than in M1, and the OSL ages for this phase fall between 84.6 ± 5.8 ka and 76.6 ± 3.1 ka (Jacobs et al. 2006a,b,c) (Fig. 2). Similar ages for the M2 phase were obtained using the electron spin resonance method (Jones 2001). The older ~85 ka old levels of the M2 phase (CG levels) (Fig. 2) seem to represent a hiatus at the site and do not have artefacts associated with the Still Bay. The more recent levels of the M2 phase contain these markers and this infers that the age of 76.8 ± 3.1 ka for the CF level (Jacobs et al. 2006a) (Fig. 2) should be regarded as the terminus post quem for the Still Bay levels at Blombos. Until recently published dates were not available for Sibudu (Wadley 2007) or Diepklouf (Rigaud et al. 2006), but provisional dates suggested the Still Bay at these two sites falls within the range reported for Blombos (Minichillo 2005: 99; L. Wadley, pers. comm. 2007). This suggestion has now been verified by the work of Jacob and Roberts (2008) who calculated the OSL ages for the Still Bay at Sibudu at 70.5 ± 2 ka ago, and for Diepklouf at between 70.9 ± 2.3 and 73.6 ± 2.5 ka ago. They suggest that the start and end of the Still Bay respectively correspond to 71.9 ka (95% confidence interval: 75.0–71.0 ka) and 71.0 ka (95% confidence interval: 72.0–67.1 ka). This suggestion, as they point out, is based on just four observations yet they are confident that the Still Bay was a short lived techno-tradition that lasted perhaps for only a few hundred or thousand years with a core date of about 71 ka.

**BACKGROUND TO THE HOWIESON’S POORT**

The backed pieces and small blades or bladelets recovered by Stapleton and Hewitt (1927, 1928) during excavations in 1926 at the Howieson’s Poort shelter near Grahamstown, Eastern Cape Province, were assigned to the Middle Stone Age. The fossile d’industrie of the Howieson’s Poort Industry were listed by Stapleton and Hewitt (1927, 1928) as backed trapezes, large segments (also called crescents or lunate), burins, trimmed...
points and obliquely pointed blades. Mostly, the Howieson’s Poort artefacts were smaller than those of typical MSA assemblages, but the backed pieces were larger than those of the Later Stone Age (LSA) Wilton. At about the same time as Stapleton and Hewitt were doing their research, Goodwin associated the ‘lunates’ that had been collected from open sites near Cape Town with his ‘Still Bay’ material (Goodwin 1926; Goodwin & van Riet Lowe 1929: 120).

Excavations by Singer & Wymer (1982) at the Klasies River site and later by H.J. Deacon (e.g. Deacon & Geleinse 1988; Deacon & Wurz 1996; Wurz 2000) confirmed that the Howieson’s Poort belonged in the MSA. MSA phases, named MSA III & MSA IV (Singer & Wymer 1982: 112–114) overlie the Howieson’s Poort levels at Klasies River and this pattern has been observed at a few other sites (Volman 1981, 1984; Thackeray A.I. 1992; Wurz 2000). There is some evidence for long range transport of fine-grained raw materials in the Howieson’s Poort, and silcrete, lydianite and quartz were the preferred materials (Lombard 2005a). This arguably precocious pattern of raw material collection is reported at some African sites during the MSA (e.g. McBrearty & Brooks 2000; Ambrose 2001, 2006; Henshilwood et al. 2001a), but is absent at others. At Sibudu and Rose Cottage the lithic raw materials were obtained from sources close to each site. At Rose Cottage opalines dominate all assemblages from the pre-Howieson’s Poort to the LSA (Harper 1997; Wadley 1997; Wadley & Harper 1989; Soriano et al. 2007).

HOWIESON’S POORT SITES AND MATERIAL CULTURE

Most Howieson’s Poort sites occur south of the Zambezi River and at least 25 sites have been reported (Lombard 2005a). An explanation for this geographical distribution is that there was a shared concept of artefact style and a related exchange of information limited to the area in which it was shared (Deacon 1992: 181). In the Western Cape Province the principal Howieson’s Poort sites are Boomplaas Cave, Diepkloof Rock Shelter, Klasies River, Klipfonteinrand, Montagu Cave, Nelson Bay Cave, Peers Cave, Trappieskop, Tunnel Cave, Skildergatkop (Volman 1981: 149) (Fig. 1) (see Lombard 2005a for full Howieson’s Poort site details and references).

Howieson’s Poort-like assemblages are reported from Central and East Africa and other parts of southern Africa. For example, there are reports of a Bambatan site in Botswana, with an age estimate of ~70–80 ka, containing artefacts similar to Howieson’s Poort artefacts (Brooks et al. 1990), a Bambatan/Tshangulan site in Zimbabwe (Deacon J. 1995; Barham 2000), and site at Mumba in Tanzania (McBrearty & Brooks 2000). Ambrose reports a similar industry at the Noritiushan site in Kenya (Mellars 2006). Although age estimates are lacking for most of these eastern and central African sites, the similarity between the artefacts found at the sites and Howieson’s Poort artefacts has led to speculation that the Howieson’s Poort, and possibly the Still Bay, may have originated in these more northerly regions (Mellars 2006: 9384).

Key aspects that link Howieson’s Poort lithics with behaviour considered ‘precocious’ or ‘modern’ (Foley & Lahr 1997; Mellars 2006) are the microlithic blades and backed tools that were probably used in the manufacture of hafted composite tools (Deacon 1992, 2001; Wurz 1999, 2000; Ambrose 2001, 2006; Henshilwood & Marean 2003, 2006). Characteristic of the industry are the retouched short, thin blade blanks with high-angled off-centre platforms (Wurz 2000: 138). These were possibly hafted in the same way as smaller segments were hafted in the LSA to make arrow heads, but their larger size suggests the armatures were used in the construction of spear heads (Deacon 1992: 180).

The presence of microlithic backed pieces in the Howieson’s Poort by at least 65 ka ago suggests a sophisticated technology that would not be out of place in the LSA (Deacon 1992, 2001; Wurz 2000; Minichillo 2005). Contrary to Mellars’ (2006: 9384) suggestion there is no evidence that this ‘precocious’ industry originated elsewhere, nor that it was the product of...
people from another region (also see Singer & Wymer 1982). Wurz’s (2000) analysis of the lithics from the Howieson’s Poort levels at Klasies River supports a local origin and shows them to be an integral part of the MSA in the Cape region.

Ochre is frequently collected and used in the Howieson’s Poort (e.g. Wurz 2000; Henshilwood et al. 2001a; Watts 2002; Rigaud et al. 2006). The amount of ochre increases compared to earlier periods, there is a greater variation in colours (Wurz 2000; Watts 2002), and the powder produced by scraping the ochre was probably used in a symbolic context (Deacon H.J. 1995, 2001; Wurz 2000). Ochre with incised patterns, similar to that reported from Blombos (Henshilwood et al. 2002) is reported from Diepkloof (Rigaud et al. 2006: 841) and at Hollow Rock Shelter (Evans 1994). Ochre was also used in practical ways and its use in hafting is now well described (Gibson et al. 2004; Wadley et al. 2004; Wadley 2005a; Lombard 2006b). The iron compounds in ochre, particularly the iron salts, have a powerful astringent and antiseptic effect, indicating that ochre powder may also have been used to assist the healing process. For example, some indigenous Australians use ochre powder to arrest haemorrhaging and to promote healing (Velo 1984).

Bone tools are rarely found in Howieson’s Poort levels, but Sibudu is reportedly one exception (Backwell et al. 2008). A midshaft fragment of a large limb bone fragment was recovered from the Howieson’s Poort Layer 20 (Cave 1a) at Klasies River. The surface is weathered and has polish in places. Four parallel lines were incised on this surface with a sharp lithic point and although these incisions were made after the piece had weathered, their antiquity is supported by their condition. These lines were deliberately engraved, which suggests they are symbolic markings (d’Errico & Henshilwood 2007). A bone point with most of its surface covered in a thick layer of manganese and showing traces of manufacture was recovered by Jolly from the talus slope at Peers Cave in 1947. In many respects it is similar to a bone point found in the Still Bay levels at Blombos Cave (Henshilwood et al. 2001b). Carbon and nitrogen analysis of the Peers bone point indicates it derives from either the Still Bay or Howieson’s Poort levels (d’Errico & Henshilwood 2007).

Numerous pieces of ostrich egg shell, several of which are deliberately incised with parallel or cross-hatched geometric motifs are a significant find in the Howieson’s Poort and Post-Howieson’s Poort complexes at Diepkloof (Parkington et al. 2005; Rigaud et al. 2006: 842). They are perhaps the most obvious examples of symbolic markings in the Howieson’s Poort period.

**AGE ESTIMATES FOR THE HOWIESON’S POORT (Table 1)**

An age of about 70 ka for the Howieson’s Poort at Klasies River is indicated by Deacon (1989, 1992), but a series of ages based on the thorium-uranium method give an average of about 65 ka (Vogel 2001). A suite of luminescence dates for Klases indicate an even younger age of about 50–60 ka (Tribolo 2003; Valladas et al. 2005). Francis Thackeray’s (1992, 2007) estimates of 58–48 ka based on microfauna, oxygen and deuterium isotope ratios and marine molluscs correlate with the luminescence dates. Thorium-uranium estimates of 70–60 ka are reported for the Howieson’s Poort levels at Boomplaas (Vogel 2001). Luminescence estimates of 74–60 ka ago (Parkington 1999) are provided for the Howieson’s Poort at Diepkloof, but it seems these estimates may be too old (Rigaud et al. 2006) (Table 1). Tribolo (2003) and Jacobs and Roberts (2008) report Howieson’s Poort ages for the type site in the range of 65–55 ka ago.

The Howieson’s Poort levels at Sibudu Cave have OSL ages between 61.7 ± 2.0 and 64.7 ± 2.3 ka ago (Jacobs & Roberts 2008). The coldest phase at the site, the post-Howieson’s Poort, is estimated at ~60 ka ago (Herries 2006; Wadley 2006b; Wadley & Jacobs 2006; Jacobs et al. 2008). At Rose Cottage Cave, the Howieson’s Poort age estimates using the thermoluminescence method are 60–55 ka (Tribolo 2003; Valladas et al. 2005) (Table 1), but the OSL ages fall between 63.0 ± 2.3 and 65.0 ± 3.0 ka ago (Jacobs & Roberts 2008). Gibson et al. (2004) suggest an age of 60–56 ka for the Howieson’s Poort at the same site. A considerably older age of 80 ka is reported for the Howieson’s Poort at Border Cave, based on electron spin resonance (Grün & Beaumont 2001). Tribolo (2003) suggests this estimate may be too old and Feathers (2002) indicates his support for a younger range of age estimates of ~60–55 ka ago for the Howieson’s Poort. When the estimates for the above sites are combined (Jacobs & Roberts 2008) they indicate a mean age for the Howieson’s Poort of 59.1 ± 1.2 ka, an oldest date of 65 ka with a 95% confidence interval of 66.0–62.8 ka; and that it lasted until 59.5 ka with a 95% confidence interval of 61.6–57.7 ka (Table 1). If these ages are correct they suggest that about 5–7 ka separates the final stages of the Still Bay and the earliest stages of the Howieson’s Poort (Fig. 3).

**FIG. 3.** Suggested start and end age estimates for the Still Bay and Howieson’s Poort phases in the Western Cape.

**PALAEOENVIRONMENTAL CHANGE AND HUMAN RESPONSE**

Any attempts to examine the interplay between climatic variation and human behavioural response during the Still Bay and Howieson’s Poort need to rely on accurate regional climatic data and well-defined and dated archaeological evidence (Deacon & Lancaster 1988; Butzer 2004). A summary of the archaeological data for the Still Bay and Howieson’s Poort periods has been presented above and a brief background to some of the causes of climatic variation during the Last Glacial is provided here.

Slow, but regular changes in the shape of the orbit and tilt of the earth’s axis, an effect known as orbital forcing (Milankovitch cycles), affect climate (Grindley 1969; Lambeck et al. 2002: 199–202; Meissner et al. 2003; Masstronuzzia et al. 2005). Interplay of orbital forcing and variations in the interaction of atmosphere, oceans, ice and earth add further complexity to the weather patterns during the Middle to Late Pleistocene. A little understood, but climatically important event occurred at about 800 ka ago when the frequency of cycles in climatic variation changed from 41 ka to ~100 ka (Kim et al. 1998; Lambeck et al. 2002: 200). Within the ~100 ka glacial cycles are shorter cycles of tens of thousands or thousands of years. Changes in the orbit of the earth affect the amount of...
light reaching the surface, an effect known as solar insolation, resulting in variations of up to 25% at mid-latitudes. Solar radiation is a measure of the solar radiation energy received on the earth’s surface during a specific time (Kim et al. 1998; Ganopolski & Rahmstorf 2001; Lambeck et al. 2002; Rahmstorf 2002; Kershaw et al. 2006; Scholz et al. 2007). One result of this variation is a build-up or decrease in polar ice volume that affects global sea-levels during glacial and interglacial periods. The exact causes of these fluctuations are not clear, but sea-levels during the last glacial synchronize with oscillations in insolation at ~40 ka and ~20 ka year cycles (Kim et al. 1998; Lambeck et al. 2002; Kershaw et al. 2006).

During periods of major glaciations leading to regressions in sea-level, water vapour is transported to the poles and the lighter oxygen isotope becomes depleted in the oceans. Low values of the isotope ratio of δ18O/δ16O of sea water relative to the SMOW (standard mean ocean water) indicate lowered ice volumes and warmer temperatures and high values correspond to the opposite (Lambeck et al. 2002; Kershaw et al. 2006). Marine foraminifera shells are a method for measuring these isotopic changes because their shells record the chemical signatures of the water in which they grew and the ratio of the two oxygen isotopes 18O/16O (Lambeck et al. 2002; also see Thackeray, J.F. 1992, 2007).

Based on patterns of fluctuation in oxygen isotope ratios in marine sediment, the last glacial cycle is divided into marine oxygen isotope stages 1–5. The odd numbered stages (1, 3, 5) are generally warm and start in the Holocene, and the even numbered stages (2, 4) are cold (Table 2). The Last Interglacial falls within MIS 5e and the stages thereafter, 5d–5a, reflect a series of oscillations between colder stadials and relatively warm interstadials. During MIS 4–3 the cold stadial periods increase in intensity and the warmer interstadials are increasingly brief. The Last Glacial Maximum (LGM) falls within MIS 2 followed by a return to warmer, interglacial Holocene conditions in MIS 1 after 12 ka ago (Lambeck et al. 2002; Rahmstorf 2002; Mastronuzzi et al. 2005).

### TABLE 2. Age estimates for MIS stages 5b–3. The estimates for the MIS stages do not correlate exactly due to variance in the dδ180 climate record, which can be attributed to a linear response to the orbital forcing (Martinsson et al. 1987: 19) and variations in dating methods and results.

<table>
<thead>
<tr>
<th>MIS Stage</th>
<th>Range of age estimates (ka)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIS 5b</td>
<td>95–80</td>
<td>Bateman et al. 2004</td>
</tr>
<tr>
<td>Range 95–85 ka</td>
<td>95–85</td>
<td>Willoughby 2007</td>
</tr>
<tr>
<td>MIS 5a</td>
<td>90–70</td>
<td>van Andel 1989</td>
</tr>
<tr>
<td>Range 90–70 ka</td>
<td>86–74/70 (transition to MIS 4)</td>
<td>Butzer 2004</td>
</tr>
<tr>
<td>Range 75–59 ka</td>
<td>73 (transition to MIS 4)</td>
<td>Bateman et al. 2004</td>
</tr>
<tr>
<td>Range 70–56</td>
<td>72 (transition to MIS 4)</td>
<td>Willoughby 2007</td>
</tr>
<tr>
<td>Range 75–65</td>
<td>85–75</td>
<td>Burge &amp; Shulmeister 2007</td>
</tr>
<tr>
<td>Range 70–60</td>
<td>91–74</td>
<td>Shackleton et al. 1984</td>
</tr>
<tr>
<td>Range 75–59 ka</td>
<td>60–59 (transition to MIS 3)</td>
<td>Butzer 2004</td>
</tr>
<tr>
<td>MIS 3</td>
<td>60–32</td>
<td>Lambeck et al. 2002</td>
</tr>
<tr>
<td>Range 64–32 ka</td>
<td>60–40 ?</td>
<td>Carr et al. 2006</td>
</tr>
<tr>
<td></td>
<td>63–45</td>
<td>Willoughby 2007</td>
</tr>
<tr>
<td></td>
<td>64–32</td>
<td>Willoughby 2007</td>
</tr>
</tbody>
</table>

**MIS 5b–MIS 5a (MSA II/STILL BAY)**

Global climatic conditions for these marine isotope stages are generally cold (Lambeck et al. 2002) with minima in insolation. In the winter rainfall zone (WRZ) of the Cape it was cool with strong trade winds (Carr et al. 2007b). Sea-levels dropped to between ~40 m to ~60 m below present (Lambeck et al. 2002; Bateman et al. 2004; Carr et al. 2007b) and aeolianite deposition intensified between 88–90 ka ago. Renewed aeolian activity at ~90 ka ago is confirmed in the Wilderness area (Bateman et al. 2004: 1691), at Pinnacle Point (Marean et al. 2007: 905) and near Still Bay (Roberts et al. 2008). Climatic data derived from fauna collected at number of sites in the southwestern Cape, including Sea Harvest, suggest cool and moist conditions with open grassland vegetation during MIS 5b (Butzer 2004). At
HoeWalle in the southern Cape the uppermost aeolianite deposition corresponds with the transition from MIS 5a–5b at ~80 ka ago (Bateman et al. 2004: 1692). The MSA II industry that preceded the Still Bay in the Western Cape probably falls within the final phases of MIS 5b (Chase & Meadows 2007) and the early phases of MIS 5a. At Cave 1 and 1a at Klasies River a high concentration of shell in the MSA II SAS levels suggests warmer conditions prevailed at the start of MIS 5a with sea-levels relatively close to the site (Thackeray, J.F. 1992).

Drill cores from three lakes in East and West Africa reflect periods of extreme aridity in the tropical climate zone for the period 135–70 ka ago. A reduction of 95% in lake volume is suggested for these sites indicating MIS 5e–5b was one of the driest periods in the African Quaternary (Scholz et al. 2007). After ~70 ka ago and coinciding with the MIS 5a/4 transition a major rise in lake levels is recorded indicating a return to wetter, stable conditions in this region. By 50–35 ka ago lake levels were similar to the present. The authors propose that an effect of the harsh climatic conditions would have been to drive humans out of the arid sub-tropical areas. Once wetter conditions returned after ~70 ka ago they would have facilitated the human expansion out of Africa that started after ~80–60 ka ago (Scholz et al. 2007; also see Mellars 2006).

**MIS 5a/4 (STILL BAY)**

The age estimates for the Still Bay levels at Blombos Cave fall between ~77 and 72 ka ago (Fig. 2) and preliminary age estimates for the Still Bay at Diepklouf and Sibudu fit within this bracket (Minichillo 2005; Wadley 2007; Z. Jacobs, pers. comm. 2008). The makers of this techno-tradition lived in the Western Cape and KwaZulu-Natal during the later stages of MIS 5a and the early transition to MIS 4. The early and middle stages of MIS 5 are characterized by interstadial conditions with rising sea-levels after ~86 ka ago that persisted until ~74–70 ka ago (Butzer 2004: 1774). A transgression of sea-levels from ~60 m in MIS 5b to ~20 to ~30 m in MIS 5a is reported globally (Lambeck et al. 2002) and sea-levels in the Mediterranean were ~35 m to ~40 m at ~80 ka ago (Shackleton et al. 1984). In the Western Cape there is no evidence of a MIS 5a shoreline, but evidence from the Huon Peninsula and Barbados shows sea-levels similar to the present during MIS 5a (Bard et al. 1990; Lambeck & Chappell 2001). The latter evidence is broadly consistent with that for South African sea-levels during the same period (Ramsay & Cooper 2002; also Chappell & Shackleton 1986).

Climatic conditions during the early and middle stages of MIS 5a in southern Africa are likely to have been mild and warm (van Andel 1989) with wetter conditions initially. At Still Bay fossilized footprints of the elephant, *Loxodonta africana* with an age estimate of ~90 ka ago indicate higher precipitation levels than at present and that woodlands may have extended close to this region during the early stages of MIS 5a (Roberts et al. 2008). The presence of the common duiker, *Sylvicapra grimmia*, in the ~76 ka M2 phase at Blombos suggests a bushy environment. Southern redbuck, *Redunca arundinum*, a water-dependent species, occurs in the M1 and M2 phases and provides a further indicator for relatively wet conditions during these MSA occupations (Henshilwood et al. 2001a; Hillestad-Nel, in press). Precipitation at ~80 ka ago at the Pretoria salt pan (Partridge 1993: 240) and at Cape Point (Shaw et al. 2001) supports this scenario, but with cooler conditions likely on the Cape Peninsula. The western frontals systems that carry moisture to the WRZ are characteristic environments that support the WRZ. With stadials increasing in intensity and broad interstadials. Aeolianite deposition during ~80–60 ka ago is recorded at a number of sites in the southern Cape (Bateman et al. 2004; Butzer 2004; Carr et al. 2007; Roberts et al. 2008). Dune formation in the southern and southwestern Cape is characteristic of falling sea-levels and the exposure of coastal plains, which supply windblown sands (Tankard & Schweitzer 1974; Tinley 1985).
Contrary to this argument, Faure et al. (2002: 47) propose that during low sea-level stands in Africa fresh water would flow onto emerging shelves. As the ocean regressed the gradient of the coastal water table increased and concomitantly amplified the hydrostatic head on groundwater aquifers inland. On the Agulhas shelf up to 120 m of hydrostatic pressure would have been released resulting in an enhanced flow of groundwater to the coast. In their ‘coastal oasis’ model Faure et al. (2002: 54) suggest the perennial fresh water supply to the exposed coast resulted in a rapid colonization of vegetation and terrestrial animals, including humans. Following this model the volume of sand available for dune formation during periods of marine regression would thus be minimized (also see Barvis & Tankard 1983; Illenberger 1996). Significant aeolian deposition in the southern Cape after the MIS 5e high stand when sea-levels were rapidly changing (Hearty et al. 2007) suggests that aeolian sedimentation follows interglacials and is not necessarily a function of exposed shelves. Aeolianite deposition at the MIS 5/4 boundary and into the MIS 4 interstadiast follows this pattern signifying conditions in the southern Cape at the transition were wetter and cooler (Bateman et al. 2004).

During the terminal phases of the Blombos Still Bay occupations climatic conditions were probably also becoming colder and wetter as a result of fluctuating sea-levels. Deposition of the sterile Hiatus dune (Fig. 2) directly above the final Still Bay, with an age estimate of 67.8 ± 4.29 ka, further supports the model for dune accretion suggested by Bateman et al. (2004) and provides important data on the deteriorating palaeoenvironment during the M1 phase of occupation. It is interesting that a reported lack of carbonate in the sediments formed during MIS 5/4 is attributed either to the source of the sand being terrestrial or to changes in the positions or strengths of the Benguela and Agulhas currents. The presence of Donax serrus, a sand-burrowing mollusc that appears in the M1 phase at Blombos correlates with the formation of a beach close to the cave. A lower shellfish density of 17.5 kg per cubic metre in the Agulhas, a sand-burrowing mollusc that appears in the M1 phase at Blombos correlates with the formation of a beach close to the cave. A lower shellfish density of 17.5 kg per cubic metre in the M1 phase of occupation supports the contention of a retreating sea. The development of a coastal plain well beyond the present coastline is likely for both the Still Bay and Howieson’s Poort periods. Sea-levels –60 m below present would have exposed a coastal plain up to 5 km wide at Klaisies River during MIS 4 (van Andel 1989). The wide and shallow Agulhas shelf seawards of Blombos Cave indicates that up to 25 km of coastal plain may have been exposed during the final Still Bay occupations. Van Andel (1989: 140) describes the exposed continental shelf as a broad and mainly flat coastal plain. There seems little doubt that humans would have taken advantage of the subsistence opportunities provided by these newly formed lands, especially those offered by terrestrial mammals that had moved into this well-watered and vegetated area (for example see Faure et al. 2002; Faught 2004; Turney & Brown 2007). At Klaisies River rocky hills, now submerged and about 20 km from the present shore, may have provided attractive subsistence opportunities and shelter (van Andel 1989: 138). Living sites dating to the Still Bay and Howieson’s Poort periods were likely inundated when sea-levels rose after MIS 4 and most of the previously exposed plain disappeared. For most of the glacial period the sea was only a few kilometres beyond the present shoreline (van Andel 1989: 140).

### Table 3: Numbers and percentages of bifacial points, *Nassarius kraussianus* beads, bone tools, engraved ochre pieces and ochre pieces from the M1 and M2 Still Bay phases at Blombos Cave. The M1 phase is divided into (1) M1a (undated) and includes levels CA, CAA, CAB, CAC, CAD; (2) M1b (age estimate ~72 ka) including levels CB, CC, CCA, CCC, CCO, CD, CDII, CDC, CE; and (3) M2 (age estimate ~77 ka) including levels CB, CFA, CFB/CFC.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Bifacial points</th>
<th>N. kraussianus beads</th>
<th>Bone tools</th>
<th>Engraved ochre</th>
<th>Ochre pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>n</em></td>
<td>%</td>
<td><em>n</em></td>
<td>%</td>
<td><em>n</em></td>
</tr>
<tr>
<td>M1a</td>
<td>101</td>
<td>36.72</td>
<td>37 (7)</td>
<td>31.62</td>
<td>4</td>
</tr>
<tr>
<td>M1b</td>
<td>168</td>
<td>61.10</td>
<td>70 (7)</td>
<td>59.83</td>
<td>28</td>
</tr>
<tr>
<td>M1 (total)</td>
<td>269</td>
<td>97.82</td>
<td>107</td>
<td>91.45</td>
<td>32</td>
</tr>
<tr>
<td>M2 (total)</td>
<td>6</td>
<td>2.18</td>
<td>10</td>
<td>8.53</td>
<td>21</td>
</tr>
<tr>
<td>M1 &amp; M2 (total)</td>
<td>275</td>
<td>100</td>
<td>117</td>
<td>100</td>
<td>53</td>
</tr>
</tbody>
</table>

MIS 4/3 (HOWIESON’S POORT)

The majority of age estimates for the Howieson’s Poort (Table 1; Fig. 3) suggest this facies of the MSA starts in MIS 4 and continues into MIS 3 (e.g. Thackeray 2007). A rapid regression of sea-levels (van Andel 1989; Avery 1995; Lambeck et al. 2002) marks the start of MIS 4 at ~70 ka ago (Fig. 2) with colder and drier climatic conditions in the Cape region. At the interface of MIS 5a/4 global sea-levels fell at a rate of 10 m per thousand years and continued falling for 6 ka (Faure et al. 2002). Between 55–40 ka ago sea-levels were stable at ~60 m to ~40 m below present (Fig. 2) and at Sodwana Bay there is evidence of a major shoreline sequence preserved at this level on the continental shelf (Ramsay 1994; Ramsay & Cooper 2002). At Blombos the Still Bay period extends over about 5 ka (Fig. 2). Considerable changes in sea-level, palaeoclimatic and probably subsistence opportunities are supported by the various lines of evidence discussed above. From conditions that were relatively benign at ~76 ka ago it seems colder, perhaps drier conditions and falling sea-levels would have impacted on the hunters-gatherer-fishers that occupied Blombos Cave. During the course of one or several generations the observed changes were likely minimal, but compounded over millennia the impact may have been considerable.
Sea-levels (Carr et al. 2006) and a likely expansion of the WRZ (Chase & Meadows 2007). Charcoal dated at >40 ka from Elands Bay Cave (Parkington et al. 2000) and botanical and faunal remains from ~65–55 ka old levels at nearby Diepkloof indicate the presence of afromontane taxa and cooler, moister conditions (Trilo 2003; Chase & Meadows 2007; Chase & Thomas 2007) during the Howieson’s Poort occupations on the Cape west coast. Aeolian activity on the west coast occurs from 73–65 ka ago during periods of low sea-levels and after 50 ka ago sea-levels are ~60 m (Chase & Thomas 2007). In the southwestern Cape, Die Kelders, Elands Bay Cave and Ysterfontein are occupied early in MIS 4. Butzer (2004) suggests an increase in cave occupations at this time may relate to the extreme cold and severe climate. At Die Kelders the fauna in the MSA II levels signify that initial climatic conditions in MIS 4 in this region are cool and moist (Butzer 2004: 1774), but later deteriorate (Chase & Meadows 2007).

Overall assessments of climatic conditions at the start of the Howieson’s Poort and throughout most of MIS 4 in the Western Cape indicate cool, moist conditions with lowered sea-levels (e.g. Ramsay & Cooper 2002; Bateman et al. 2004; Butzer 2004; Chase & Meadows 2007; Chase & Thomas 2007). Howieson’s Poort levels at the majority of sites (Table 1) have age estimates post ~65 ka ago and fall within the MIS 3 stage. No sites have ages after ~48 ka ago, suggesting the Howieson’s Poort terminated before the end of MIS 3. This would place most of the Howieson’s Poort techno-tradition within the ~65–55 ka old periods that Chase and Meadows (2007: 119) describe as ‘extremely harsh’. Initially, cold conditions persist at the start of MIS 3, but gradually there are warm oscillations, although sea-levels remain at ~40 m below present from 55–40 ka ago, except for slightly higher levels at ~50 ka ago (Ramsay & Cooper 2002). Lunette accretion in the southern Cape between 60–45 ka ago provides support for lowered sea-levels (Carr et al. 2006). Dry and windy conditions during the 55–40 ka old period (Deacon & Lancaster 1988) are indicated by the charcoal and pollen record from Boomplaas and lunette deposition is recorded at Soutpan and Renosterkop Pan (Carr et al. 2006). It is likely that strong trade wind flow with high amplitude fluctuations occurred throughout MIS 3 (Chase & Meadows 2007: 114).

A recent revision by Francis Thackeray (2007) of the data Pillans et al. (1998) obtained from changes in marine shell concentrations relative to a sea-level curve for the Late Pleistocene provides new insights into subsistence patterns and the palaeoenvironment during the Howieson’s Poort occupations at Klacies River. The density of shellfish declines in the Howieson’s Poort levels compared to earlier and later MSA occupations at the site.

Thackeray suggests this decline coincides with lower sea-levels and a greater distance from the site to the shore. By comparing shellfish densities with sea-level changes Thackeray suggests the Howieson’s Poort occupations were likely to be within the 61–56 ka period. This contradicts the earlier ~70 ka old age estimates suggested for the Howieson’s Poort at the site (Table 1). Shortly after the end of the Howieson’s Poort occupations the warmest period of MIS 3 is recorded (~56–52 ka ago) and it coincides with the MSA III occupations. Thackeray’s findings further support the notion that the Howieson’s Poort was restricted to the coldest parts of MIS 4/5 and that once climatic conditions ameliorated this techno-tradition ended.

Case Studies—Blombos Cave and Klacies River

Rapid expansion of social learning and the use of symbolic culture to mediate human behaviour may be related to adaptations to highly variable environments (Richerson & Boyd 1998; Alvard 2003). Technological complexity and curation of material culture is likely to increase in cold climates or during periods of social and/or environmental stress (Henshilwood & Marean 2003, 2006). If models linking cultural complexity with ecological variability are correct would this fit the environmental conditions in the Western Cape during the Still Bay and Howieson’s Poort techno-traditions?

During the initial phases of the Still Bay during MIS 5a at ~77 ka ago conditions in the Western Cape Province, particularly in the southern Cape, were mild with moisture levels higher than during the Late Holocene (Henshilwood et al. 2001a). On both the west and southern Cape coasts the ocean and coastal plains offered a rich source of readily accessible nutrients. (Henshilwood & Sealy 1997; Henshilwood et al. 2001a). In particular, seafood would have provided nutrients, now known to be important in infant brain development, specifically the omega-3 fatty acid, docosahexaenoic acid (Broadhurst et al. 2002). Ecological conditions during mid-MIS 5a were certainly conducive to population growth in the Western Cape. This was not the case in the tropical and subtropical zones in east and central Africa where drought conditions persisted from ~135–70 ka ago (Scholz et al. 2007). Expansions of humans from these regions in southerly and perhaps northerly directions are not unlikely (Marean & Assefa 2005; Mellars 2006; Wadley 2007).

Although there is no direct evidence at this stage, it is conceivable that the Still Bay techno-tradition of bifacial points emanated from further north because the points bear at least some resemblance to the lanceolates of the final Lupemban–Tshitolitan tradition from Twin Rivers in Zambia with a provisiona naturalage estimate of ~95 ka old or later (Clark & Brown 2001) and to some of the thin elegant lanceolates found in the Lupemban at ~300 ka ago (McBrearty 1988). The distinct physical similarity between these Zambian lanceolates and those of the Aterian Industrial complex present in North Africa at about ~80–70 ka ago is noted by Clark and Brown (2001: 325). Whether a Pan-African cognitive system was then operational is speculative, but it is possible that there was a drift of ideas from south to north and vice versa, that may have coincided with the movement of people. Local variants in the Western Cape of the Still Bay and Howieson’s Poort may have developed in situ and could represent two examples of localized evolution.

During the later stages of MIS 5a and into the early stages of MIS 4 environmental conditions in the Western Cape deteriorate and lowered sea-levels, sea surface temperatures and precipitation are reported (Vimeux et al. 1999) (Fig. 2). The densities of shellfish collected at Blombos, for example, decrease as sea-levels fall in the latter stages of the Still Bay. Changes in the vegetation of the Western Cape suggest drier and cooler conditions prevailed with increased aeolian deposition on the coastlines in the southern and western Cape. By 70 ka ago the entrance to Blombos Cave was blocked by aeolian sand (Jacobs et al. 2003 a,b) and the Still Bay occupations ceased at this site.

During the latter stages of the Still Bay occupations in the Western Cape, and perhaps in KwaZulu-Natal, maintaining good social relations amongst regional groups may have been vital. Environmental degradation would have placed greater stress on subsistence strategies, and increased demographic pressure on coastal areas may have resulted from groups being
forced to move out of the arid interior regions of the Western Cape. One way of ensuring good social relations between groups, or even within groups, is through the exchange of high value items. Exactly how or which items of recovered Still Bay material culture played a symbolic role, or whether a form of *kuro* (exchange) even took place, is largely speculative. Blombos Cave, Hollow Rock Shelter, Peers Cave and Dale Rose Parkour seem to represent ‘craft specialization’ locations during the Still Bay phase. At these sites there appears to be an emphasis on regionalism through the production of distinctive bifacial points, often in very large quantities. It is tempting to speculate that these artefacts, and perhaps others, served a practical and symbolic role (Henshilwood et al. 2001a; Henshilwood & Marean 2003, 2006; Mellars 2006).

The Still Bay levels at Blombos Cave provide a useful case study for assessing, at least at this site, whether intensification in the production of material culture with possible symbolic connotations may be related to environmental change. Of the artefacts recovered from the Still Bay levels at Blombos perhaps the beads and the engraved pieces of ochre are the best candidates for the ‘symbolic’ artefact category, but bifacial points, ochre and some bone tools may also have served a symbolic role. Most are present in small numbers in the M2 phase corresponding with the start of the Still Bay (Table 3). A rapid increase in the numbers of these artefacts in the M1b phase corresponds fairly well with deteriorating climatic conditions at about 72 ka ago. Almost 60% of the bifacial points (n = 168) and beads (n = 70) were found in this phase. The highest numbers of bone tools (n = 28) and at least two engraved ochre pieces date to this period as well (Table 3).

The highest quantity of ochre is also reported in the M1 phase (74%). In the terminal phases of the Still Bay occupations the numbers of these artefacts decreases, especially the bone tools and bifacial points (Table 3). The exact significance of these decreases is unclear, but they may signal a lesser importance placed on symbolic material culture. Additionally, the decrease in numbers of bifacial points and bone tools may indicate a change in the tools used for hunting and processing that was precipitated by environmental change. In either event the intensity of manufacture of tools and objects with possible symbolic value decreases just prior to the final phases of the Still Bay occupation. Subsequently the cave was abandoned and shortly thereafter the entrance was closed by aeolian sand (Jacobs et al. 2006a).

The recent dating of Howieson’s Poort levels at a number of sites in the Cape (e.g. Feathers 2002, in press; Tribolo 2003, Jacobs 2004; Tribolo et al. 2005) (Table 5) suggests there was a gap of 5–10 ka between the end of the Still Bay and the start of the Howieson’s Poort. If this is the case then the intermediate MSA level that is sandwiched between the Howieson’s Poort and Still Bay at Diepkloof (Minichillo 2005) may provide some crucial pointers to the occupation of the Western Cape between ~70 ka and 66 ka ago. The dating of the lower Howieson’s Poort levels and the upper Still Bay levels at Sibudu will at least provide age estimates for this transition in KwaZulu-Natal.

A post-Still Bay hiatus, although hypothetical at this stage, may link to a period of human expansion, perhaps climate driven, out of the Cape via the east coast and northwards along a coastline exposed by lower sea-levels. Ameliorating climatic conditions reported for East Africa after ~70 ka ago (Scholz et al. 2007) may have encouraged this process. The expansion of the L2 and L3 mtDNA lineages at this time and the correspondence of a demographic and geographical expansion out of Africa at about 60–80 ka ago also fit this model (Stringer 2000; Rose 2004; Forster 2004; Mellars 2005; Hudjashov et al. 2007). A genetic study of Ethiopians shows they share with the Khoisan the deepest human Y chromosome clades (Semino et al. 2002: 266), and supports the contention that Khoisan territory once extended north of the equator as far as Ethiopia and Sudan (Nurse et al. 1985). Most of the Ethiopian Y-chromosomes and some of the Khoisan Y-chromosomes belong to Group III and it was the precursors of this group that first expanded out of Africa (Semino et al. 2002: 267).

Howieson’s Poort sites are more numerous in southern Africa (see Lombard 2005a) than are Still Bay sites suggesting higher population levels in the region after ~65 ka ago. This could be ascribed to the arrival of new groups from other areas or simply to an expansion of local populations. Singer and Wymer (1982) attribute the start of the Howieson’s Poort at Klasies River to the arrival of new people in the region, a view not supported, for example, by Anne Thackeray (1989). She interprets the co-existence of earlier lithic styles and the new backed elements in the Howieson’s Poort as support for continuity. The start of the Howieson’s Poort coincides with the early or middle phase of MIS 4, one of the coldest stages in the Last Glacial. Deacon (1989, 2001) suggests that the elaboration of material culture was a coping mechanism to deal with the environmental stress that placed social structures under pressure during MIS 4. A decline in available prey species during this period may also have contributed to the stress (Minichillo 2005). The Howieson’s Poort phase in southern Africa does not contain those elements that typify the Still Bay, especially the bifacial points, nor the beads and engraved pieces of ochre. However, the typical ‘symbolic markers of the Howieson’s Poort, the trapezes, crescents (segments) and allied forms, are considered a precocious technology for the MSA (Mellars 1989, 2005; Foley & Lahr 2003). Bone tools are present (Backwell et al. 2008), ostrich eggshell is engraved with geometric patterns (Rigaud et al. 2006) and subsistence behaviour is indicative of behavioural modernity (Deacon 2001). As is the case in the preceding Still Bay, it seems that human behaviour during the Howieson’s Poort period was mediated by symbolism, at least a part of which is reflected in the recovered material culture.

The classes of lithics that best fit the ‘symbolic’ artefact category for the Howieson’s Poort are crescents, trapezes, triangles and obliquely blunted points (Singer & Wymer 1982: 95; Wurz 1999). It is tempting to relate the increase or decrease of these artefacts within Layers 10–21, the Howieson’s Poort layers at Klasies River, to environmental conditions. If the interpretation of the Blombos data presented above is correct, the expectation is that the production of ‘symbolic’ artefacts increases when environmental conditions deteriorate. There is considerable frequency variation in the production of these artefacts at Klasies River (Fig. 4). Crescent production peaks at the late stages of the occupation (Layers 10–11) and in the initial stages (Layers 19–20). Trapezes are absent in the final stages (Layers 10–13), peak in the middle (Layer 17) and peak again near the initial occupation (Layer 19). The highest frequency of obliquely blunted points occurs in the final stages (Layers 10–13), the middle (Layer 17) and the initial stage (Layer 20) (Fig. 4). In the Howieson’s Poort levels at Klasies River, 60% of the backed artefacts recovered are crescent (segment)-shaped, 11% are trapezoidal and 29% are intermediate (Wurz 2000: 97). Together, these figures and the temporal distribution of these forms, contradict the argument suggested by Singer & Wymer (1982: 112) that trapezes and segments served different functions. Contrary to Singer & Wymer’s viewpoint, Wurz (2000: 97) suggests they should rather be subsumed within a single artefact class.
A broad assumption may place Layer 21 at Klasies River at about 65 ka (Vogel 2001), or perhaps 60 ka ago (Tribolo 2003, Valladas et al. 2005) and Layer 10 at ~55 ka or 50 ka ago (Tribolo 2003; Valladas et al. 2005; Thackeray 2007). The initial occupation (Layers 21–17?) was likely to have been a time of falling sea-levels (van Andel 1989; Lambeck et al. 2002) with a cold and dry climate in the southern Cape. Sea-levels may have been as much as ~60 m below present (Ramsay 1994; Ramsay & Cooper 2002). Sea surface temperatures during MIS 4 decreased to ~15°C from ~20°C in MIS 5a. Similar conditions existed in other areas of the Western Cape Province, for example, at Boomplaas (Scholtz 1986: Chase & Meadows 2007) and at Diepkloof (Tribolo 2003; Chase & Meadows 2007; Chase & Thomas 2007). At other sites in the southwestern Cape at this time, for example, at Die Kelders, Elands Bay Cave and Ysterfontein, cold and severe conditions occurred (Butzer 2004).

The Howieson’s Poort lithics data (Fig. 4) at Klasies River do not seem to show a direct correlation between the production of ‘symbolic’ lithics and climatic variation at Klasies River. The overall pattern is that the highest frequencies of all three artefact classes were produced during the initial stages of occupation when climatic conditions were most severe (~65–60 ka ago?) and in the final stages (Fig. 4) during MIS 3 (~50 ka ago) when sea-levels are rising and sea surface temperatures increasing (Vimeux et al. 1999; Ramsay & Cooper 2002). Previous studies of the differences in shape and frequencies of crescents and trapezes across the various layers at Klasies River (Singer & Wymer 1982; Volman 1984) focussed on finding a cultural significance in these variations. Wurz (2000: 97), however, suggests these studies of stylistic significance are indeterminate due to idiosyncratic variation and the limitations imposed by sampling. Similarly, it seems that, at least at Klasies River, production of ‘symbolic’ lithics does not correspond to climatic variation and the possible social and subsistence stresses that this imposed.

The end of the Howieson’s Poort may be linked to relief from this environmental stress and a reversion to an earlier, simpler technology (Deacon 1989; Lombard 2005a). Minichillo (2005) suggests that once climatic conditions improved the cost of the Howieson’s Poort technologies became too high. A slightly contrary view is that the latter part of the Howieson’s Poort, at least at Klasies River, coincides with warmer conditions during MIS 3 and that the demise of this techno-tradition may have taken several millennia (Thackeray 2007).

DISCUSSION
In this paper I address some of the issues that surround the contributions of climatic change to cultural innovations, the possible reasons for their introduction and the subsequent, apparent discontinuity of some of these trends in the Western Cape Province. Examining all the processes that interacted and generated the cultural variants that define the Still Bay and Howieson’s Poort is beyond the relatively limited knowledge of these periods, but an avenue that has been pursued in the past, and is worth pursuing in the future, is the relationship between human behaviour and climate.

The innovative technologies and social practices recorded at archaeological sites during the period 77–50 ka ago in the Western Cape Province are only one part of a behavioural montage that also spread across other regions in Africa at this time. Rapid advances in human cognition after ~200 ka ago, partly driven by climatic variability, manifest in material culture practices not previously observed in the MSA. After ~100 ka ago symbolically mediated behaviour seems strongly allied to material culture. The innovations that are manifest during the Still Bay and Howieson’s Poort periods may have been driven by group or individual endeavours to adapt or adopt technology to cope with variable environments, so-called “variability selection” (Alvared 2003: 142). These artefacts, it seems, functioned symbolically as mechanisms for social cohesion, although the adaptive advantage of the acquired capacity for complex human culture probably only became apparent when complex traditions began to evolve. Human culture can be minimally defined as socially transferred information that has
Once the capacity for complex human culture was in place, whether it was genetically driven or not, the process that followed is unlikely to have been random. Cultural novelty is never random, but is generated and assimilated both strategically and contextually (Gabora 2001: 219). Innovation is a reflection of the accumulated knowledge of individuals, the circumstances in which they find themselves, and the social context in which they are embedded. Innovations will thus have a much better than chance probability of being fitter than their predecessors (Boyd & Richerson 1985; see Shennan 2002).

Theoretically this may explain why the key features of Howieson’s Poort and the Still Bay material cultures appear so different. What worked for one group at ~75 ka ago may not have worked for another at ~55 ka ago. The incremental, marginal modifications built up over many generations contributed to the complexities of subsistence systems, material culture and languages during the Still Bay and Howieson’s Poort. We are able to work only with a fraction of the knowledge that was driving these processes at that time, but amongst this complexity it seems that climatic determinants, as is the case today, were a major driver in promoting innovation and variability in material culture in the past.

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