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THE QUARTZ CONUNDRUM



**UNDERSTANDING THE ROLE OF QUARTZ IN
THE COMPOSITION OF LATE PLEISTOCENE
AND HOLOCENE LITHIC ASSEMBLAGES FROM
THE VERLORENVLEI AREA, WESTERN CAPE**

by
Jayson Orton

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OF LATE PLEISTOCENE AND HOLOCENE LITHIC ASSEMBLAGES
FROM THE VERLORENVLEI AREA, WESTERN CAPE**

(Volume 1)

by

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**Dissertation submitted in fulfilment of the requirements for the award of the degree of
Master of Arts in Archaeology**

Department of Archaeology

Faculty of Humanities

University of Cape Town

March 2004

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in this dissertation from the work, or works of other people has been attributed, and has been cited and referenced.

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ABSTRACT

This research explores the related roles of quartz and bipolar reduction in the composition of Later Stone Age (LSA) lithic assemblages from the Verlorenvlei area, Western Cape Province. With few exceptions, these two elements strongly dominate the assemblages from this area, and the attitudes to and reasons for their continuous use are considered here.

Discussions on typology and raw material classification illustrate and attempt to solve problems existing in current systems, and a comprehensive classification scheme for the western Cape area is provided. The use of an innovative analytical technique, in which each raw material is assessed individually, allows considerable variation in the flaking and subsequent use of each material to be demonstrated. While fine-grained rocks are undoubtedly preferred for artefact manufacture, overall raw material proportions are clearly determined by the ubiquitous availability of quartz in the study area, but less important factors, virtually impossible to differentiate from the lithics alone, are undoubtedly also implicated.

Technological change related to the use of quartz and bipolar flaking is explored through three critical periods, the late Holocene, the terminal Pleistocene/early Holocene, and the late Pleistocene. In order to ascertain the factors governing assemblage composition, the frequencies of various artefact types are compared with those of quartz and bipolar cores by means of scatter plots. Correlation coefficients are calculated to assist the analysis of the data, but due to the small sample sizes some visual interpretation of the graphs based on intuitive archaeological knowledge is also essential. Considerably different approaches to the reduction of quartz are demonstrated for each period, with distinct strategies of raw material

conservation, each operating in a different manner, existing throughout most of the LSA. These promoted the variable use of bipolar and non-bipolar reduction techniques and microlithic technology in order to make best use of the relatively intractable quartz on offer in the local landscape. Such strategies only broke down during the late Holocene, possibly due to the changing social relations that must have occurred with the introduction of pastoralism to the area some 2000 years ago. The nature of industrial change is also explored, and it is evident that in this area the LSA lithic sequence constitutes a continuous progression of sporadic change with no distinct breaks or periods of absolute stability being apparent.

It is recommended that larger sample sizes be used in similar future analyses in order to alleviate the difficulties inherent in drawing general conclusions from small sets of data. The frequency of chips in any assemblage is shown to be unreliable and their exclusion from comparative typological data will lend greater validity to all lithic analyses.

Cover: an exposure of the Piekenierskloof conglomerate near Spring Cave, on the north-facing slopes of Bobbejaansberg, Elands Bay. The karabiner for scale is 10 cm long.

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CONVENTIONS

Certain terms have been used in this dissertation which are not necessarily strictly correct but have been incorporated in keeping with precedents set by other workers in the field of Later Stone Age archaeology. What follows is a list of these terms, briefly explaining their usage.

- The different word forms of *Early*, *Middle* and *Later*, used in describing the three periods of the Stone Age, are archaeological conventions, although *Late* is also occasionally used. I have elected to maintain the use of *Later*.
- *Western Cape*, *Eastern Cape* and *Northern Cape* refer to the current political provinces of South Africa, while *western Cape*, *southern Cape*, *south-western Cape*, *eastern Cape* and *northern Cape* are used in a more general sense to refer to the relevant part of the old Cape Province. In practice, the latter terms are frequently more useful than the modern provincial boundaries, since archaeological research in the past has typically focussed on these areas separately with the result that each has taken on a geographical implication more localised than the new political boundaries. Note that, although the non-hyphenated form of directions such as ‘*south-west*’ are commonly used in archaeological literature, this form is not used here since it is not a specific archaeological convention and, following the Oxford Dictionary, is technically incorrect (Thompson 1998).
- In archaeology, the term *terminal Pleistocene* describe a far shorter period than it does in quaternary studies more generally. In keeping with this, I have used *late Pleistocene* to refer to the period roughly between 18 000 and 11 000 years ago, and *terminal Pleistocene* to refer approximately to the final millennium of the Pleistocene.

- The use of the term *nonmicrolithic* without a hyphen is based purely on the precedent set by others. English dictionaries list most such words in the hyphenated form, but for the sake of consistency, I have elected to maintain the non-hyphenated version.
- Two spellings of *Verlorenvlei* exist (with or without the ‘n’) and appear to be entirely interchangeable. *Verlorenvlei* retains its early Dutch roots and is the name of the original farm, while *Verlorevlei* is the local, Afrikaans version (Sinclair 1980). In common with most authors, I have elected to maintain the ‘n’.

1 INTRODUCTION

For many years research into stone artefact assemblages focussed on establishing typologies and chronologies. Since the 1960's archaeologists have begun to seek answers to different types of questions – “not so much what happened when as what differences in stone tools made at the same time mean” (Binford & Binford 1969:70). In this study, even more detailed questions regarding raw material use are asked of Later Stone Age lithic assemblages from Elands Bay on the west coast of South Africa (Figure 1.1).

The research examines the lithic assemblages from archaeological sites located near the lower reaches of the Verlorenvlei River (32°19'S;18°20'E; Figures 1.1 & 2.2). An innovative analytical technique, in which each raw material is examined individually as a separate assemblage, is employed in an attempt to gain some insight into the decisions taken by the makers of the stone artefacts, especially decisions relating to raw material selection for formal tool manufacture. Although some researchers do record the raw materials for each artefact class, these data are seldom published or given adequate consideration, sometimes deliberately so, during the interpretation of the assemblages (e.g. J. Deacon 1978:92). Otte (1992:47) has even remarked of the European Middle Palaeolithic that “if separate analyses were made on the different raw material types, one would conclude that different assemblage groups were present”.

General patterns in the lithic assemblages of this part of South Africa have long been recognised (Parkington, pers. comm.). These include the trend towards a greater reliance on local raw materials through the Holocene (Parkington *et al.* 1988) and, most notably, the domination of quartz throughout the period under examination and its even stronger showing

in the earlier and later millennia of this period. It is still not known, however, what the driving forces behind the creation of these patterns were. Manhire (1984, 1987) also recognised a high incidence of quartz at sites close to Verlorenvlei and could only surmise that the close proximity of conglomerate quartz may have had an effect on raw material frequencies, but the situation must surely be more complicated than this.

Good quality quartz is seldom found due to the fact that its geological history results in the formation of many tiny fractures which cause it to break up into small, blocky chunks and short, relatively useless flakes (Dickson 1977). As a result it is certainly not an easy material with which to work, at least not for us today. There are also many other materials available that are consistently found in the archaeological record and which we would consider to be far superior for use in stone working. Despite their continuous use by prehistoric stoneworkers, these other materials seldom dominate assemblages in areas where quartz is widely available, although their quality was certainly recognised, with many tools being made on them. On the other hand, two strongly contrasting situations exist in which this pattern breaks down completely:

- In areas where quartz is readily available one sometimes finds sites such as Dunefield Midden 1 at Elands Bay (Orton 2002) and LK4 in Namaqualand (Halkett 2003; own data) (Figure 1.1) which emphasise this material to the point of almost completely excluding all other materials, both overall and from the formal tool category; and
- When quartz is noticeably less common in the landscape, assemblages such as those from Swartkop 1 in the Northern Cape (Beaumont *et al.* 1995; Orton, in press) and various sites in Lesotho (Mitchell *et al.* 1994; Mitchell 2000a) sometimes reflect the opposite pattern with very little or virtually no quartz being used.

The pattern of flaking much quartz but favouring other materials for formal tools is not uncommon, and recent excavations (Halkett 2001, 2003; Sadr et al. 2003) in areas where quartz is widely available have strengthened the pattern. Table 1.1 demonstrates this pattern for a number of sites in the Northern and Western Cape, while Figure 1.1 shows the geographical distribution of these sites. These are only a few examples and many other sites demonstrating this pattern exist in the Western Cape (e.g. Andriesgrond, (Anderson 1991), Klein Kliphuis (Van Rijssen 1992), and most Sandveld deflation hollows (Manhire 1987)).

Table 1.1 Proportions of quartz and formal tools from a selection of Western and Northern Cape sites.

Assemblage	Province	Approximate uncalibrated dates	n	Total % quartz	% Formal of quartz	% Formal of all other materials
Witklip, Unit 1	W. Cape	330 – 500 BP	637	55.10	0.85	10.49
Witklip, Unit 2	W. Cape	Undated	353	55.81	3.55	8.97
Witklip, Unit 3	W. Cape	1380 – 1860 BP	1769	58.51	1.93	8.86
Witklip, Unit 4	W. Cape	3060 BP	783	57.85	2.65	7.58
Kasteelberg G	W. Cape	~1000-2000 BP*	2165	56.67	1.14	5.22
Kasteelberg G	W. Cape	~2000-4500 BP*	1600	51.13	0.61	4.73
Sevilla 50	W. Cape	Undated	1254	58.85	1.49	5.04
Melkboom 1	N. Cape	350 BP**	2129	86.71	1.14	10.25
Biesje Poort 2	N. Cape	1870 BP**	1162	67.47	0.77	6.35
LKLG 5	N. Cape	~2000 BP	1395	96.63	2.23	8.51
KN6-3C	N. Cape	Undated	2829	67.97	0.78	13.47
Jakkalsberg N	N. Cape	4320 BP†	16 688	67.79	0.56	2.96

Sources: all own data except Witklip: Smith *et al.* (1991) * Dates from Sadr (pers. comm.)
 ** Dates from Beaumont *et al.* (1995) corrected following Vogel *et al.* (2001) † Date from Orton & Halkett (2001), corrected following Vogel *et al.* (2001)

The proportion of formal tools within the total quartz assemblage and that for all other raw materials combined is shown, and it can be seen that no matter how great or small the proportion of quartz in each assemblage, formal tools were obviously preferentially made on other raw materials. Hence one of the most important questions that this project aims to

answer: why is such a high frequency of quartz maintained in the Elands Bay lithic assemblages when other raw materials appear to have been continually available, albeit in small quantities, and sometimes also preferentially used in tool manufacture?

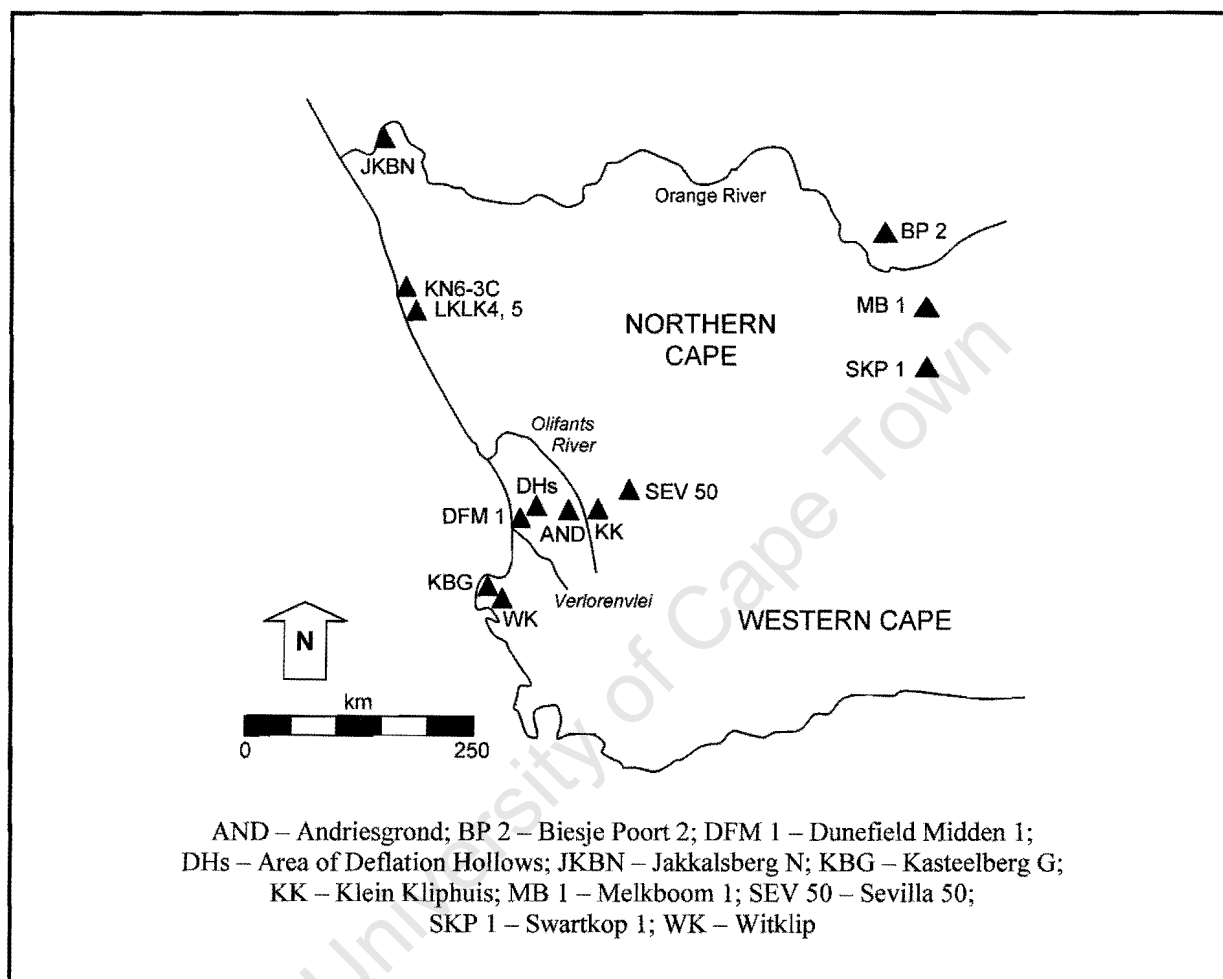


Figure 1.1 Geographical location of sites mentioned in Chapter 1.

An obvious reason to use quartz so much is noted by Dickson (1977). He points out that it would be used out of necessity when better materials are not locally available and cannot be obtained by trade. We know, however, that in the Elands Bay area there are other materials available, and that some did occasionally come from quite far away. There must, therefore, be some other reason for the extensive use of quartz in that area.

When flaked, different materials produce varying proportions of débitage, edge-damaged and formal artefacts, a point already noted by Mitchell (1988a). Certain materials are unsuitable for retouching, while others produce high quality sharp edges. In addition, some tool classes are preferentially, or even sometimes exclusively, made on specific raw materials, while others are seldom, or never, found on certain materials. This variability prompted the change in the method of analysis alluded to above. Each raw material, but focussing on quartz, is treated and analysed independently as a separate sub-assemblage, rather than looking at all the raw materials together as a whole. This serves to remove the smudging effect of the other raw materials and simplify the search for the answer to the question on the continuously high frequency of quartz as presented above.

My examination of assemblages from the Verlorenvlei area focuses on three primary temporal comparisons. Firstly, a number of Late Holocene assemblages dating after 1000 BP will be compared to examine the differences between quartz-rich assemblages from the most recent Later Stone Age sites. Secondly, the terminal Pleistocene and early Holocene occupations of Elands Bay Cave will be considered in order to explore the change in raw materials and flaking techniques employed by stone workers at a time when quartz use was at its lowest. The third aspect will involve a comparison of the late Holocene quartz-rich assemblages with similar ones from the late Pleistocene of Elands Bay Cave. This will not only serve to record the types of artefacts and materials present during each period, but will also aim to explore why people chose to make the decisions they did with regards to both raw material and tool type frequencies.

I have begun Chapter 2 with an introduction to the southern African Later Stone Age and the various industries that have been identified within it. This is followed by an overview of the

research area, including some reference to previous investigations into raw material issues there. Chapter 3 outlines the research. Methods and constraints are discussed, along with the problems of classification of both artefacts and raw materials. Chapter 4 presents each site used in this study, providing necessary stratigraphic and dating information.

In Chapter 5 the results of the lithic analyses are presented in full, and a detailed discussion of the progression of LSA lithic industries through the last 13 600 years in the Elands Bay area is provided. Chapter 6 explores and discusses the three critical temporal issues pertaining to raw material use as outlined above, providing a discussion on artefact manufacture and raw material use during the three periods explored. Chapter 7 briefly compares the Elands Bay data with some other assemblages from the Western and Northern Cape provinces in order to place the findings in a wider context. In Chapter 8, by way of conclusion, several short discussions on particular topics are presented, with specific consideration given to issues arising from the current work.

2 BACKGROUND AND CONTEXT OF THE RESEARCH

2.1 THE LATER STONE AGE AND ITS INDUSTRIES IN SOUTH AFRICA

This section presents a synthesis of Later Stone Age lithic research as it stands today, and summarises each major industrial period as currently recognised. The geographical location of each site mentioned is given in Figure 2.1.

The Stone Age in Southern Africa is divided into three major temporal units, the Early (ESA), Middle (MSA) and Later (LSA) Stone Ages. In the 1920's, two different LSA industries were identified – the Wilton, comprising the microlithic LSA assemblages, and the Smithfield, comprising the non-Wilton assemblages located in the interior (Goodwin and Van Riet Lowe 1929). The two were distinguished by the presence of the so-called ‘crescent scrapers’ in the Wilton and bored stones in the Smithfield (Van Riet Lowe 1926). It is interesting to note that in 1926 Van Riet Lowe (1926) initially regarded the Wilton as an industry produced by ‘pure’ Bushmen while seeing the Smithfield as a degraded form of the Wilton created by ‘impure’ Bushmen who had interbred with Bantu or ‘Hottentot’ people.

Since these rather crude beginnings, numerous terms have been introduced in an attempt to refine and more accurately describe the various industries present in the LSA of Southern Africa. Although many terminological differences exist, there is some agreement on the characteristics and dating of the various industries identified for the LSA (e.g. J. Deacon 1984a, Wadley 1993, Mitchell *et al.* 1996). The terms I have used for the post Last Glacial Maximum (LGM, 18 000 BP) assemblages in this summary represent a composite of terms taken from J. Deacon (1984a, b) and Wadley (1993) with one modification explained in the relevant section below to the last of the four. These terms are as follows:

- Late Pleistocene microlithic assemblages
- Terminal Pleistocene/early Holocene nonmicrolithic assemblages
- Holocene microlithic assemblages
- Late Holocene assemblages

These terms represent the broadest categories and avoid the plethora of type-site names that have emerged over the years to describe assemblages from different areas (see for example Inskip 1967; Sampson 1974). Of course there are also assemblages from the pre-18 000 BP period of the LSA and these are sometimes referred to as the early LSA (ELSA) (Beaumont & Vogel 1972; Wadley 1993). This term encompasses both microlithic and nonmicrolithic traditions. Wadley (1993) and Mitchell (2000b) have pointed out the contentious nature of the ELSA, with some aspects showing a degree of synthesis and others showing considerable discordance. The final 'tradition' is included as a means of classifying the left-over assemblages which show little or no affinity to the Wilton.

No system of subdividing the LSA will ever be perfect, since some breaking up of the general continuity will always occur (J. Deacon 1984a) and a diversion of "attention away from underlying processes and into an emphasis on punctuated models and cultural boundaries" may result (Parkington 1986b:181). Indeed J. Deacon (1974) once suggested that the Smithfield and Wilton assemblages, comprising the post-12 000 BP period, were unnecessarily separated and might be better combined into one dynamic and developing system. An overview of these technological traditions is presented below, outlining where the other terms fit in.

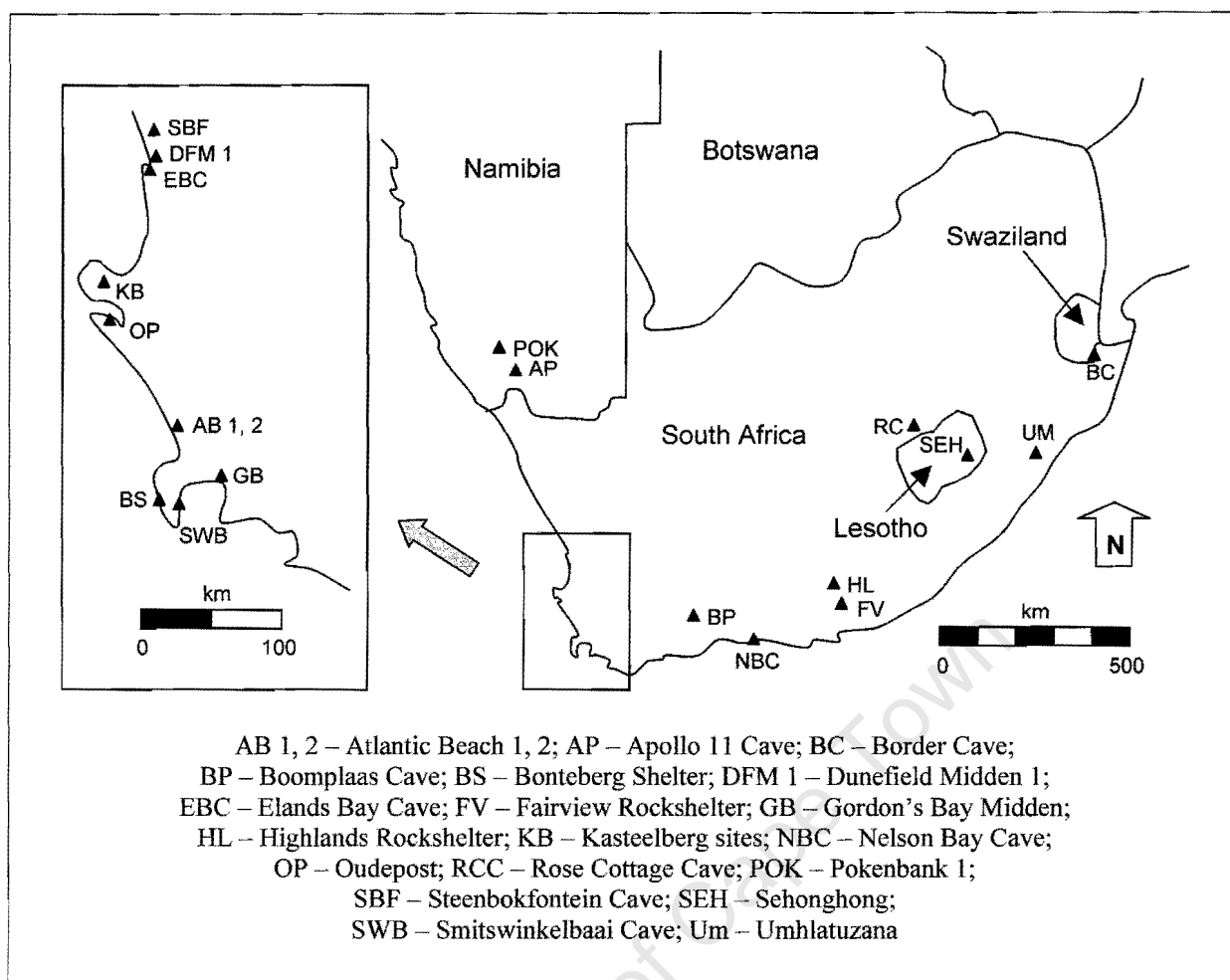


Figure 2.1 Geographical location of sites mentioned in Section 2.1.

Various arguments have been suggested to explain the changes from one industry to another, often with environmental change as their focus (e.g. H. Deacon 1972; Klein 1974). Technological change was regarded as an adaptive device for coping with new circumstances resulting from environmental change (H. Deacon 1972). More recently, J. Deacon (1984a, b; 1990) has shown that the environment did not play a major role on the basis that no direct correlation existed between industrial and environmental changes in southern Cape sites. She added that technological change essentially swept through the subcontinent from north to south, citing the spread of increased formal tool numbers in the early Holocene (Deacon 1984b:280) and the appearance of pottery in the late Holocene (Deacon 1984b:279) as clear

examples. Others have suggested social factors to have been far more important in technological change (Mazel 1987; Kaplan 1989, 1990), although little further detail is given. Parkington (pers. comm.) cautions that although it is hard to correlate environmental change with artefact change, it is impossible to say that there is no relation at all. Interestingly, a somewhat circular relationship is thought to exist between technology, environmental change and large bovid extinctions in the southern and western Cape during the late Pleistocene. The technological advancements of the LSA, specifically the manufacture of Robberg bladelets, would have allowed an increase in the hunting proficiency of hunter-gatherers which, in combination with long-term environmental change, is likely to have contributed to several of the large bovid extinctions documented for this area around 12 000 to 10 000 years ago (Klein 1980, 1984). With these extinctions, hunting techniques and technology would quite likely have had to change. J. Deacon (1988) suggests, therefore, that the cessation of bladelet manufacture in the southern Cape reflects a change in hunting weapons around 12 000 BP. This may only be a local phenomenon, however, since extinctions were regionally quite variable, with some species surviving well into the Holocene in other areas (Mitchell 2002b).

Environmental deterioration prior to the onset of the Last Glacial Maximum has also been suggested as a driving force behind the shift from MSA to LSA technology (Mitchell 1988a, b). Mitchell (1988a, b) suggested that expedient technology and raw material collection were introduced to allow more time for food procurement, although later, he modified his view indicating that there may not be such a direct correlation with environmental change (Mitchell 1994). Kaplan (1989, 1990) sees no environmental change at Umhlatuzana at the end of the MSA and proposes a gradual change from MSA to LSA technology there, with social conditions being the most important thrust behind the change.

A. Clark (1999a) has proposed that bladelet technology can be used to distinguish MSA and LSA industries. MSA bladelets, she suggests, whether produced intentionally or not, were predominantly the product of bipolar flaking, while LSA bladelets were more often produced by an indirect or punch technique. The latter produced thin bladelets with small, flat platforms, characteristics which she found to be overwhelmingly more dominant in LSA bladelets than in those from the MSA. She also sees the increased number of bladelets produced, the dominance of scrapers among the formal classes, and the presence of a conical bladelet core frequency greater than 3 to 4% of all cores as further factors distinguishing LSA from MSA technology. It is all these attributes which she finds first present in Late Pleistocene microlithic assemblages from c. 18 000 BP. The latter two characteristics are not present in the equivalent Elands Bay Cave assemblages, and with A. Clark's (1999a) work focused on other parts of southern Africa, different situations must exist in different areas. Mitchell (1988b) discusses this variation, and divides the early microlithic assemblages into two distinct areas based primarily on flaking technique, which in turn is directly related to the variable availability of raw materials.

In addition, based on the analysis of bladelet attributes, the existence of a transitional MSA/LSA industry at both Rose Cottage Cave, Sehonghong, and possibly at Boomplaas has been postulated (A. Clark 1997, 1999a, b). The transition from MSA to LSA is seen as being a slow one in which people gradually began incorporating LSA technology while continuing to manufacture MSA formal tools. It is also suggested that the switch to new tool forms only occurred after LSA technology had become firmly entrenched in the cultural framework.

This transitional period is sometimes, although perhaps incorrectly, referred to as the Early LSA (ELSA), a term originally introduced by Beaumont and Vogel (1972) to describe a

variety of assemblages which were all seen as being 'pre-Wilton'. This period is somewhat controversially dated with various authors having widely differing opinions. Early dates for the end of the MSA are between 40 000 and 35 000 BP, while late dates vary from 25 000 to 19 000 BP (Beaumont & Vogel 1972; Kaplan 1989, 1990; J. Deacon 1990; Wadley 1993). Through an analysis of the late dates in existence for the MSA at many sites in southern Africa, Wadley (1993) suggests that MSA technology could have in fact survived until as late as 20 000 BP, a date with which Mitchell (1988b, 2000b) agrees. Wadley adds that all assemblages occurring after the LGM definitely belong to the LSA. Hindsight has shown that a number of distinct industries were included within the original ELSA grouping and the term as originally defined is no longer applicable (A. Clark 1999a).

Wadley (1993) essentially regards the ELSA classification as a means of housing all those assemblages that fit into neither the MSA, nor the Robberg. All but one of these assemblages have been found in caves or rock shelters, although it is possible that there are further open sites which have yet to be discovered. This spatial distribution of sites concentrated in the mountainous areas is probably significant and may indicate that the time when these assemblages were deposited was one during which environmental conditions were less favourable than today.

Wadley (1993) sees ELSA assemblages as having only two unifying features. Firstly quartz is the dominant raw material, and secondly, the assemblages are unstandardised and contain very few formal tools. Mitchell (2003) adds that bipolar flaking is usually the preferred reduction technique. The microlithic assemblages of the ELSA typically contain a few unstandardised scrapers and a relatively common incidence of bipolar flaking, while the nonmicrolithic assemblages are less well described but contain very few bladelets and formal

tools (Wadley 1993). The term 'pre-Robberg' has also been used to describe the earliest microlithic industry at Boomplaas in the Southern Cape, where many irregular cores and few bladelets are present at about 21 000 BP (H.J. Deacon 1980 in Wadley 1993), although more recently this assemblage was firmly ascribed to the Robberg Industry (H. Deacon 1995).

Those few nonmicrolithic assemblages ascribed to the ELSA are very poorly described and seem to be labelled LSA primarily on the basis of their associated dates. They tend to be found in the north-western parts of southern Africa (e.g. Apollo 11 Cave, Pockenbank 1; Wendt 1972, 1976), with the microlithic ones concentrated in the south and east (Wadley 1993). This suggests the possibility of the co-existence of more than one technological tradition during this period. Wadley (1993) notes that, even though there are common threads running through the ELSA microlithic assemblages, it is impossible to include them all in a single coherent industry.

It has been suggested that the pre-Robberg 'ELSA' assemblages at Border Cave (Beaumont 1978) could in fact represent an industry that is transitional between the MSA and the LSA (Mitchell 1988a, b; Barham 1989b). Since it includes both microlithic and nonmicrolithic artefacts, as well as elements of both MSA and LSA technology (Wadley 1993), this is quite a reasonable suggestion. Based on an analysis of the controversial IWA assemblage from Border Cave, A. Clark (1999a) prefers to see this assemblage as MSA since the technological affinities tend far more towards the MSA than the LSA. Rose Cottage Cave also has an early assemblage once ascribed to the 'ELSA' (Beaumont 1978), but this too has since been reinterpreted as MSA (Wadley 1991). A. Clark (1999a) proposed that the term 'Early LSA' be dropped from the literature, a suggestion with which Mitchell (2003) agrees.

Kaplan (1989), working at Umhlatuzana in Kwa Zulu-Natal, identified a transitional industry in which MSA points slowly decreased in number, while bladelets and bladelet cores, typical of the LSA, increased. He found bladelets and backed tools present in the MSA levels, indicating a long-standing microlithic tradition at this site. The transition from MSA to LSA is seen as being “part of an ongoing uninterrupted sequence of events in stone artefact manufacturing systems” (Kaplan 1989:13), a view in essence, supporting those of A. Clark (1999a, b).

I now turn to a discussion of the four main subdivisions of the Later Stone Age.

Late Pleistocene microlithic assemblages

These assemblages, also known as Robberg assemblages, first appeared at the type site, Nelson Bay Cave, around 18 000 years ago (Wadley 1993), although earlier occurrences elsewhere are now also known. It has been suggested that Robberg-type assemblages could have appeared as early as 21 000 BP at Boomplaas and Nelson Bay Cave (J. Deacon 1984b, 1990), and Kaplan (1989) claims to have Robberg assemblages present before 18 000 BP at Umhlatuzana. Mitchell (1995) suggests a long presence at Sehonghong Rock Shelter with bladelet-rich assemblages being present from 20 000 to 11 000 BP. Although present at a number of sites at the LGM, they are most common and widespread between 13 000 and 12 000 BP (Mitchell *et al.* 1996), continuing in some areas until as late as the early Holocene (Barham 1989a; Kaplan 1989; Mitchell 1995; Mitchell *et al.* 1996; Wadley 1997, 2000). These assemblages typically contain a high proportion of bladelets smaller than 25 mm in length, although some sites have very few. They are struck from conical single platform cores or flat bladelet cores and bipolar cores vary from being dominant to completely absent (Wadley 1993). The frequency of the latter type before 13 000 BP at Umhlatuzana has led

Kaplan (1989) to distinguish an earlier and a later Robberg with the latter occurring between about 13 000 and 9000 BP. The formal tool count is usually very low with scrapers being the most common class, although backed tools and a few large naturally backed knives are also found. The latter are seen as an innovation of the post-13 000 BP period (Kaplan 1989). A wide variety of stone types, especially fine-grained ones, are used as raw materials (J. Deacon 1984a, 1990; Wadley 1993).

As with the earliest LSA, Robberg assemblages are only found in caves and rock shelters in the Cape Fold Mountains, the Drakensberg, Kwa Zulu-Natal and Mpumalanga (Wadley 1993). These areas have high rainfall, broken topography and greater ecological diversity (J. Deacon 1984a) and would have been attractive for occupation, since the cold, arid climates of the LGM would have made much of the subcontinent less ecologically productive (Mitchell 2000b). Some Robberg-like tools have been found in open sites in Swaziland (Price-Williams pers. comm. in Wadley 1993). The presence of naturally backed knives at some sites (e.g. Elands bay Cave (Parkington & Yates, in prep. a) and Umhlatuzana (Kaplan 1989)) is thought to be a transitional element signalling the oncoming nonmicrolithic period.

Terminal Pleistocene/early Holocene nonmicrolithic assemblages

These assemblages, characterised by low formal tool frequencies and the more frequent use of coarse-grained raw materials and irregular cores, from which large, frequently side-struck flakes were produced, are broadly equivalent to the Smithfield 'A' (Mitchell 2002b) as designated by Goodwin and Van Riet Lowe (1929).

Although these assemblages are now commonly found away from the interior region, they are still restricted to south of the Zambezi, reinforcing Goodwin and van Riet Lowe's (1929)

suggestion that they represent a local development (J. Deacon 1984b). Initially thought to have appeared around 12 000 BP (J. Deacon 1984a, b), they are now considered to date only after about 11 000 BP, or even 10 000 BP, with few sites having the industry well established before then (Wadley 2000; Table 11). The subsequent Holocene microlithic assemblages began appearing between 10 000 and 7000 years ago (J. Deacon 1984a, b), but only after 8000 BP south of the Limpopo River (Mitchell 2002b).

Sampson (1974) labelled the Smithfield A as the Lockshoek Industry, and placed it within his Oakhurst Industrial Complex, which he subdivided into the Oakhurst, found in the southern Cape, and the Lockshoek, found in the interior. The Lockshoek assemblages are found predominantly on open sites, although a few cave sites also exist. Other regional Oakhurst industries such as the Albany in the southern and eastern Cape (J. Deacon 1982, 1984a; earlier called 'pre-Wilton' by H. Deacon (1972)), and the Kuruman in the northern Cape (Humphreys & Thackeray 1983) have also been recognised. The Albany essentially occurs in and coastward of the Cape Fold mountains (J. Deacon 1984a) and would be the variant encountered at Elands Bay. Since the regional variation evident is likely to be primarily raw material-related, I shall continue the use of the more general term 'Oakhurst' for all these assemblages.

Oakhurst Industry formal tools are dominated by large scrapers of various form (J. Deacon 1984b), and naturally backed knives are also found (Mitchell 2002b). There was a major shift in raw material usage during the Oakhurst period with the larger flakes and tools requiring the use of larger blocks of raw material. This precluded the use of fine-grained siliceous rocks which tend to occur only in small nodules. As a result, hornfels (especially in the interior), quartzite, dolerite and siltstones became dominant (Wadley 1993).

Interestingly, during this time of nonmicrolithic tools, bone and shell tools become far more common (J. Deacon 1984b, Mitchell 2002b), although at some coastal sites the introduction of shell tools might be linked primarily with the rise in sea level and could thus, in the sense of Parkington (1980), be regarded as a 'change of place' phenomenon (Mitchell, pers. comm.).

An interesting innovation to take place during this period is the introduction of what are known as 'Woodlot scrapers' (Mitchell 2003; Parkington & Yates, in prep. a), or more informally, 'scraper-adzes' (e.g. Mitchell *et al.* 1994.). These artefacts are strongly standardised (Mitchell 2000) and are most noticeable in the assemblages of the southern and south-eastern parts of southern Africa (Mitchell 2003). They are also temporally restricted, occurring mainly between about 9000 and 7000 years ago (J. Deacon 1984b).

Holocene Microlithic assemblages

Wilton, a term introduced by J. Hewitt in 1921 (Goodwin & Van Riet Lowe 1929) was initially widely used to describe any assemblage which typically contained small tools, most notably segments, as well as thumbnail scrapers, drills and backed pieces (J. Deacon 1972; Parkington 1980b). The Wilton, so defined, was so broad in its geographical distribution - even being used as far afield as Somalia (J. Clark 1954) - that Inskeep (1967) began to suspect the term was being incorrectly applied. More recently the Wilton has been refined to encompass only those microlithic assemblages dating to the Holocene (J. Deacon 1984a, b).

Artefacts generally characterising Wilton assemblages are fashioned from small flakes and bladelets and include mostly scrapers, but a variety of backed tools (such as segments, borers, backed bladelets and points) usually comprise up to about 30% of all formal tools (Sampson

fasten the tools to their handles (H. Deacon 1966; H. Deacon & J. Deacon 1980; J. Deacon 1984a, b). The mastic on a mounted adze from Steenbokfontein Cave shows no evidence of having been fastened to either wood or bone (Jerardino 2001) thus opening up the possibility of some other type of handle, perhaps even a stone (Jerardino, pers. comm.). At Elands Bay Cave, a lump of mastic partially encasing a segment is considered to have been shaped to allow the tool's use as a hand-held implement (Parkington & Yates, in prep. b).

The Wilton period is likely to have been a time of many changes in settlement strategies with sporadic occupations of caves and rock shelters noted through the Holocene. This would have affected raw material use and the scheduling of tools used at each site (Parkington 1980b), thus producing a wide variety of microlithic assemblages within the Wilton period. Although seldom used today, four Wilton phases differentiating relatively minor trends have been recognised – Early, Classic, Developed and Ceramic (Sampson 1974). In the 'Classic Wilton' segments are most common, with the 'Developed' or 'Post-classic Wilton' showing more backed bladelets, backed points and adzes (Mitchell 2002b; Sampson 1974). Segments are generally expected to occur between 7000 and 3000 BP (J. Deacon 1972) and the middle part of the Wilton has smaller scrapers than before or after (Parkington 1980b). J. Deacon (1972) notes that, in general, the last 2000 years comprise a period of change in artefact manufacturing patterns, possibly due largely to the widespread social and economic changes which resulted from the introduction of domestic stock to Southern Africa.

Goodwin and Van Riet Lowe (1929) named the Smithfield 'C' industry, which they found in caves in the South African interior, and which contained many small thumbnail scrapers. Although classifying them differently, they recognised the close relationship between Smithfield and Wilton assemblages: "The affinities between "B" and "C" and the Wilton are

Smithfield and Wilton assemblages: “The affinities between “B” and “C” and the Wilton are astonishingly marked. This applies most particularly to the cave or “C” Smithfield and the Wilton, for it is almost correct to say that Smithfield “C” is a crescentless Wilton” (Goodwin & Van Riet Lowe 1929:187). Willcox (1956) pointed out that much confusion could result from the striking similarities between these assemblages and those assigned to the Wilton and assumed them to be variants of one industry. Despite this early observation, it was not until the work of Janette Deacon (1974, 1984a) that they were firmly assigned to the Holocene microlithic tradition (i.e. Wilton), but occurring only after 4600 BP.

Late Holocene assemblages

Parkington (1986) suggested that this ‘complex’ was perhaps not sufficiently cohesive to qualify as a cultural entity on its own, but I have included it here as there is certainly a different type of phenomenon happening in some of the very recent sites, at least in the southwestern Cape, which cannot be included in the traditional characterisation of Wilton assemblages. Beaumont (pers. comm. in J. Deacon 1984a) also recognises such assemblages in the Northern Cape calling them ‘Ceramic LSA’.

Sampson (1974) used the term ‘Strandloper’ to identify sites containing almost no microlithic artefacts, many large scrapers and a variety of heavy-duty artefacts such as grindstones, anvils and choppers. He assumed the term to describe any non-Wilton, coastal shell midden assemblage post-dating the Oakhurst Complex. Although nicely describing many of the assemblages with pottery, the term includes more than just these late Holocene assemblages.

In the immediate pre-pottery period, an interesting phenomenon occurs at a number of Eastern and Western Cape sites, in which a change to the sort of industry described by

Sampson (1974) takes place before about 3000 years ago. Some examples are mentioned here. At Fairview Rock Shelter in the Eastern Cape, a clear change from small, variably shaped scrapers made on a variety of materials to large, mainly endscrapers made on lydianite occurred between about 3320 and 2450 BP (Robertshaw 1984). At Highlands Rock Shelter, a similar but less pronounced change in scraper size occurred after 3570 BP (H. Deacon 1976), and at Nelson Bay Cave scraper size increased dramatically about 3200 years ago (Inskeep 1987, Appendix 21). Raw materials, however, remain constant in both the latter sites. In the south-western Cape the pre-pottery lithics at Bonteberg Shelter are strongly characterised by large quartzite artefacts (Maggs & Speed 1967), while the Gordon's Bay Midden, dated between 3200 and 2700 BP, has an overwhelmingly macrolithic character with chopper-type tools dominating (Van Noten 1974).

After 2000 BP even more informal assemblages appear, with some simply having 'smashed up' rocks and very little evidence of formal stoneworking – good examples are the Atlantic Beach sites on the coast north of Cape Town. The two dates on Atlantic Beach 1 suggest an age of about 1300 BP and the one from Atlantic Beach 3 is about 960 BP (Sealy *et al.*, in prep.). Smitswinkelbaai Cave, on the Cape Peninsula, yielded a post-2000 BP assemblage containing mainly large quartzite and sandstone flakes and chunks (Poggenpoel & Robertshaw 1981). On the other hand, some post 2000 BP sites do yield microlithic tools in reasonable numbers and these would then still be late Wilton sites in Sampson's (1974) scheme. Dunefield Midden 1 is an obvious example (Orton 2002).

Goodwin and Van Riet Lowe's (1929) Smithfield 'B' is now regarded as being a late Holocene industry (J. Deacon 1984b; Sampson 1974). J. Deacon (1984b) considers all Smithfield Industries other than 'A' and 'C' to belong to this period and Mitchell (2002b)

states that the term 'Smithfield' is now best used specifically with reference to those late Holocene interior assemblages associated with ceramics.

This period is complicated by the arrival of pastoralism to the Cape. Hunter-gatherers and herders have been shown to produce very different lithic assemblages (Smith *et al.* 1991,1992), with the latter being quite informal and containing far fewer retouched tools. It was argued that hunter sites included small beads, few ceramics and the bones of many hunted animals, and herder sites large beads, many ceramics and mostly domestic animal bones. The pattern was shown to have continued well into historical times (Smith *et al.* 1991).

Leading out of an analysis of the indigenous artefacts from Oudepost, near Saldanha Bay (Schrire & J. Deacon 1989), Schrire sparked a debate on the archaeological identity of hunter-gatherers and herders in the south-western Cape which, despite the efforts of Smith *et al.* (1991), has never been fully resolved. At this site she found a small assemblage of artefacts which, through comparison with other assemblages excavated nearby, Smith *et al.* (1991) considered to have hunter rather than herder affinities. Schrire (1992) believed the distinctions drawn by Smith *et al.* (1991) to be vague, with too much overlap. To some degree, the debate has turned full circle with the variety among recent sites sparking new suggestions that one group of people may be responsible for both archaeological signatures, at least at sites in the Kasteelberg area (Sadr *et al.* 2003).

Table 2.1 summarises the above discussion indicating the broadest trends noticeable in each period across southern Africa. The dates are loose approximations, and much regional variety occurs.

Table 2.1 Summary of the Later Stone Age in Southern Africa as presented in Chapter 2.

Period	Dates	Typical characteristics
'Early Later Stone Age' or 'Pre-Robberg'	First LSA until c. 18 000 BP	Microlithic: few formal tools but some scrapers are found. Bipolar flaking and quartz commonly used. Nonmicrolithic: few bladelets and formal tools.
Late Pleistocene microlithic assemblages	c. 18 000 – c. 11 000 BP	Many bladelets (<25 mm), single platform and flat bladelet cores. Few formal tools but scrapers most common. Quartz or fine-grained rocks used.
Terminal Pleistocene/early Holocene nonmicrolithic assemblages	c. 11 000 – c. 8000 BP	Irregular cores, large scrapers of various shapes and naturally backed knives occur. Coarse-grained raw materials predominate.
Holocene Microlithic assemblages	c. 8000 BP – present	Wide variety of small scrapers and backed pieces common, with scrapers usually dominant. Fine-grained rocks most often used.
Late Holocene assemblages with pottery*	Post c. 2000 BP non Wilton	Very few formal tools and many larger artefacts found in association with pottery. Can be microlithic or nonmicrolithic.

*Note that similar assemblages also occur in the immediate pre-pottery period, mostly in the Eastern Cape.

2.2 THE VERLORENVLEI AREA

2.2.1 Brief archaeological history

There is a long, but discontinuous, history of prehistoric settlement in the Verlorenvlei area (Figure 2.2). The main reason for this is undoubtedly the coincidence of fresh water from the Verlorenvlei River, the rocky shore marine resources available around Baboon Point and Mussel Point further south, and shelter in the form of the caves and rockshelters which abound in the Bobbejaansberg mountain.

The basal deposits in Elands Bay Cave contain MSA artefacts and it is thought that the cave might have only been a quarry site at this time, since no occupational debris is present with the lithics (Parkington 1992). Volman (1984) proposed the assemblage to be a middle Pleistocene early MSA industry. Miller (1987) suggested earlier occupation around the Last Interglacial to be unlikely with raised sea levels causing variable flooding of the areas to the north and south of Baboon Point and leaving the point very exposed. Some 15 km upstream,

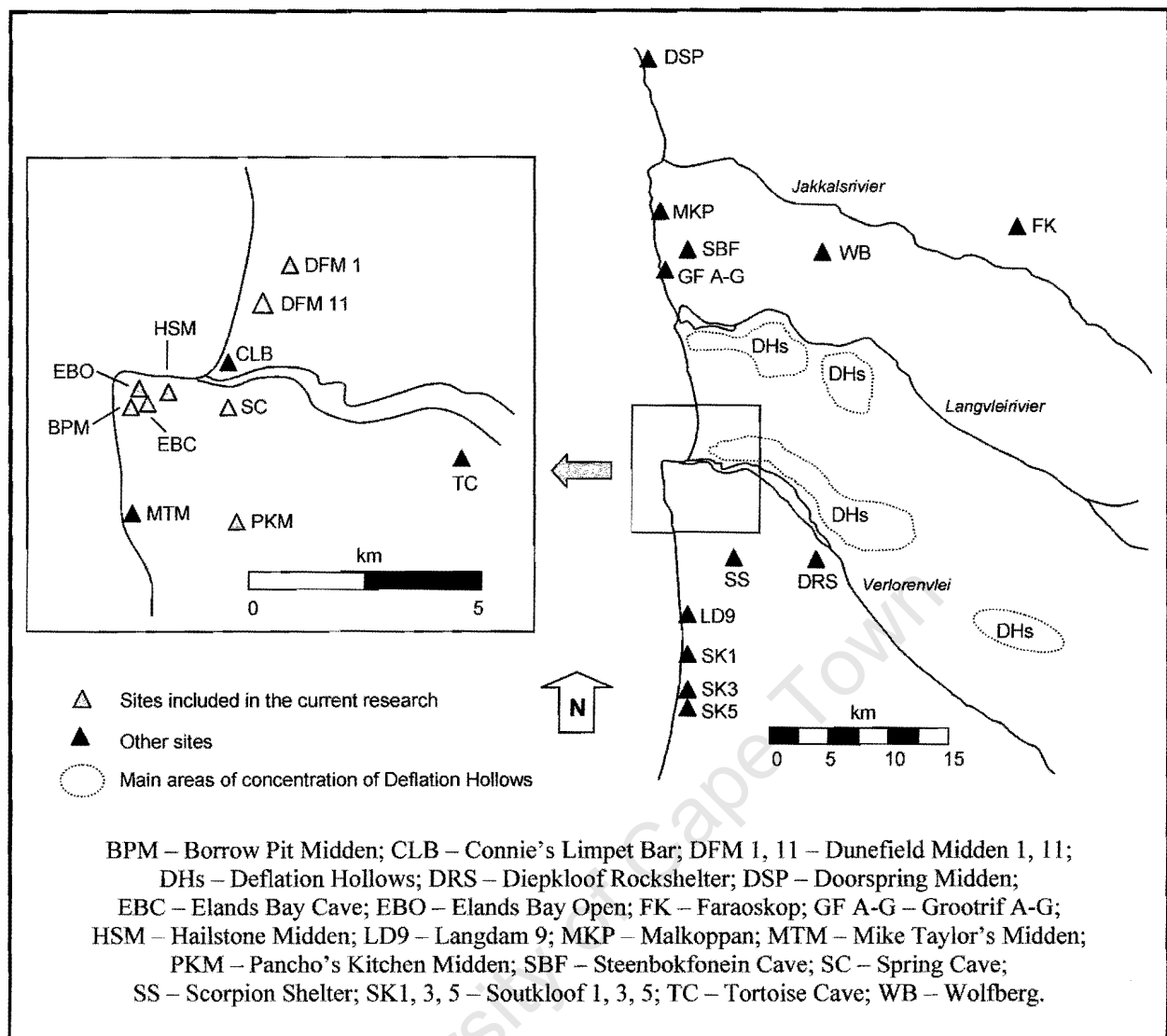


Figure 2.2 Geographical location of sites mentioned in Section 2.2.1 and all sites included in the current research.

the site of Diepkloof, although containing only post-1700 BP LSA deposits (Manhire et al. 1984; Parkington 1977; Parkington & Poggenpoel 1987), has very extensive, deeply stratified MSA deposits (Poggenpoel, in prep.). These are the only other known MSA deposits in the area, although a large open scatter of MSA artefacts has been recorded at Wolfberg, 20 km north-north-east of the present study area (Manhire 1987). Sporadic MSA artefacts are found on LSA sites, and were probably collected from sites such as Wolfberg.

An interesting phenomenon occurred in Elands Bay with a number of occupational hiatuses being present throughout the period under study. Early occupation of the Verlorenvlei area is very limited, with only EBC having been occupied until just after 8000 years ago when Tortoise Cave (TC) was first occupied (Jerardino 1995). The only other late Pleistocene occupation known from the western Cape area is that at Faraoskop, some 32 km north east of Elands Bay (Manhire 1993). Parkington *et al.* (1988) point out that this dearth of late Pleistocene sites is quite real and assume that very few of what are now coastal sites were occupied during this period. A likely reason for this is that low post-LGM sea levels would have put the more attractive coast some 35 to 40 km further west (Parkington 1988). Although EBC, with its enlarged Pleistocene floor area (Parkington 1992), undoubtedly contains substantial deposits predating 8000 BP, the post-LGM sequence is by no means complete with some 4000 years of the Late Pleistocene seeing the cave unoccupied (Parkington, in prep. b, Table 2:1).

There is also an extensive mid-Holocene occupational hiatus around Elands Bay with occupation ceasing at EBC about 7900 years ago and at TC some 6800 years ago. At both sites occupation resumed from c. 4300 BP (Jerardino 1995; Parkington *et al.* 1981; QUADRU, n.d.). During this time a higher sea level may have put fresh water beyond reasonable reach of Elands Bay Cave and made the environment within the cave particularly unpleasant due to increased sea spray and frequent mists. In addition, the productive rocky shelves that are currently exposed to wave action would have been submerged, thus significantly reducing shellfish resources (Parkington 1984). Interestingly, this hiatus does not occur at Steenbokfontein Cave some 20 km to the north, with dates of 4620 ± 70 BP (Pta-7323) and 6070 ± 80 BP (Pta-6808) being present (Jerardino 1996; Jerardino & Swanepoel 1999). With these dates coming from units in close proximity to one another, the

possibility of a shorter hiatus than that which occurred at Elands Bay still exists. Visser & Toerien (1971) report that the spring near Steenbokfontein yields better water than most others, suggesting a possible reason for this continued occupation. The midden site of Doorspring, near Lamberts Bay, with dates of 4052 ± 35 BP (Pta-6742) (corrected -438 years) (see Section 4.2 for details of correction procedure) and 5033 ± 50 BP (Pta-6740) (corrected -497 years), also displays occupation during the Elands Bay hiatus and is the only other dated mid-Holocene occupation on that part of the west coast (Jerardino 1996). The background scatter found in the gravel underlying Dunefield Midden 1 (Orton 2002) is as yet undated, but initial indications suggest that it too may well be a true mid-Holocene assemblage possibly dating between 4000 and 6000 BP.

Parkington *et al.* (1988) see the mid-Holocene high sea level as a major factor in the Elands Bay hiatus with almost all the intertidal, shellfish-rich rocky platforms being drowned during this high stand. A local increase in aridity is also thought to have occurred during the mid-Holocene. This would have led to a reduced exploitation of the area by hunter-gatherers compared to earlier or later times (Manhire *et al.* 1984). The recent climatic amelioration and resulting lower sea levels would have encouraged renewed use of the coast (Miller 1987), most obviously expressed in the massive 'megamiddens', as they became known (Buchanan 1988), deposited in the third millennium BP (e.g. Mike Taylor's Midden, Grootrif A-G, Jerardino 1996; Jerardino & Yates 1997).

Spring Cave (Parkington *et al.* 1988), Scorpion Shelter (Wahl 1994) and Pancho's Kitchen Midden (Jerardino 1996, 1998) were first visited about 3500 years ago, while the many undateable deflation hollow lithic assemblages studied by Manhire (1984, 1987) are thought, by comparison with the Tortoise Cave assemblages, to date to around this time as well. The

4000 to 1700 BP Tortoise Cave assemblages appear similar to those from the deflation hollows and since no comparable assemblages are found on the surface of any Sandveld rockshelters, this period seems reasonable for the occupation of the hollows (Manhire *et al.* 1984). In addition, most rockshelters in mountain areas were not occupied as far back as 4000 BP suggesting that open sites were preferred then (Parkington *et al.* 1988). The deflation hollow assemblages were seen as long term accumulations, but with most of the artefacts having been deposited between 3800 and 1700 BP (Manhire *et al.* 1984). More recent work at Steenbokfontein Cave has suggested, however, that the deflation hollow assemblages are more likely confined to before 3000 BP (Jerardino & Yates 1996).

Coastal occupation debris during this period does not seem to be very substantial with only a few shell middens accumulating in front of three or four caves between 4400 and 3000 BP (Parkington *et al.* 1988). It is suggested, however, that further excavations in the area could increase the number of pre-3000 BP occurrences (Parkington *et al.* 1988), although the extensive sampling and dating programme carried out by Jerardino (1996) on previously unexcavated sites failed to accomplish this in the vicinity of Elands Bay. Only one date significantly over 3000 BP was obtained during her project, and that was for the site of Malkoppan just south of Lamberts Bay, which yielded a date of 4230 ± 60 BP (Pta-6220).

While occupation centred on rock shelters and caves prior to 3000 BP, the following millennium saw numerous open middens accumulating with an apparent cessation in the regular use of caves (Jerardino & Yates 1996). Many of these were the megamiddens that accumulated next to intertidal rocky platforms (Parkington *et al.* 1988; Jerardino & Yates 1996), while others were smaller, such as those spread along the sandy coastline south of Elands Bay (e.g. Langdam 9, Soutkloof 1, 3 & 5; Jerardino 2003). The former type are

strongly dominated by the black mussel, *Choromytilus meridionalis*, with early work (e.g. Henshilwood *et al.* 1994, Parkington *et al.* 1988) suggesting that few other artefacts were present. These megamiddens are thought to have represented only a part of the subsistence pattern for this period (Parkington *et al.* 1988) perhaps being food-processing locations where shellfish was dried and taken elsewhere for consumption. It is thought that, with the lack of local cave and rockshelter deposits dating to this period, the dried meat may have been taken to occupation sites further inland (Henshilwood *et al.* 1994). More recently it has been suggested that these megamiddens, may have functioned as campsites as well (Jerardino & Yates 1997). Through density-based calculations on material from Mike Taylor's Midden, Jerardino and Yates (1997) showed that in the entire midden there may well be a fair amount of faunal and cultural material present, but that this is dwarfed by the sheer volume of shell such that few other remains are found per unit volume. Parkington (pers. comm.), however, maintains the view that these sites represent a rather different phenomenon to other similar, but smaller volume sites, since people must clearly have carried out far more activities related to shellfish than to other types of remains.

The smaller sites along the sandy coast stretching to the south reflect brief occupations after about 3000 BP. Although five of the six dates so far obtained fall into the millennium preceding 2000 BP, the presence of pottery on many of the other recorded sites suggests frequent visits to the area after this time (Jerardino 2003).

At Pancho's Kitchen Midden, Jerardino (1998) was able to show that the diet of hunter-gatherers before 3000 BP was focused on terrestrial sources (mainly mammals), while during the megamidden period (3000 – 2000 BP) diets changed to highly predictable sources such as

tortoises and shellfish, but were dominated by marine foods. After 2000 BP there was an apparent return to the pre-3000 BP dietary structure.

Deposits dating after 2100 BP, when the megamiddens appear to have stopped accumulating, reflect a pattern of vastly reduced volumes of deposit being produced, but with a richer array of artefacts and food remains (Parkington *et al.* 1986; Parkington 1987; Jerardino & Yates 1996). Soon afterwards, and broadly contemporary with the introduction of pottery to the area at about 1800 BP, there is a substantial increase in the number of sites occupied (Manhire *et al.* 1984; Parkington *et al.* 1986, 1988). In addition, there is also a resurgence in the use of rockshelters with many small ones throughout the coastal plain and the Cape Fold Belt mountains containing ephemeral occupations. Manhire *et al.* (1984) point out that a high proportion of these sites are very small and must represent short, infrequent visits. After 1000 BP further open sites were visited, creating more of a mix of open, rock shelter and cave sites; there is also a further increase in the total number of sites (Jerardino & Yates 1996).

Rudner (1968) recorded twelve sites in the Elands Bay area and collected pottery from each of them. Despite this ubiquitous presence of pottery on so many of the recent sites, no clear herder occupations are known, with all currently excavated and recorded sites said to be those of hunter-gatherers. This pattern holds true for most of the Cape west coast. Although unlikely, Dunefield Midden 1 might be an exception, and is elaborated further in Section 6.5.1. The existence of stone walling on top of the Steenbokfontein koppie is thought to be evidence of herders having lived in that area at some stage (Yates, pers. comm.), while at Diepkloof, with its small but significant sheep bone assemblage (Parkington & Poggenpoel 1987), similar walling both on the slope in front of the cave and in the neighbouring rock

shelter (Parkington, pers. comm.), perhaps provide even more tantalising evidence of stock-keeping.

Final prehistoric occupation of the Elands Bay area is likely to have occurred some 300 years ago, shortly after the arrival of European farmers to the area, while the latest radiocarbon dates available suggest that EBC was used until at least 320 years ago and Spring Cave until a little after 460 BP. Connie's Limpet Bar (Jerardino 1996) at the mouth of Verlorenvlei and Diepkloof Rockshelter (Parkington 1977) some 15 km upstream both yielded dates of c. 390 BP. The first colonists are known to have travelled through the Verlorenvlei area within a few years of Van Riebeeck's arrival in 1652, and to have explored to the mouth of the river by the late 1600's (Sinclair 1980). In 1731 the first allocations of land to white farmers were made along the Verlorenvlei River and the first house was erected just before 1750 (Sinclair 1980). White farmers were, however, using the area from about 1710 onwards, and Gribble (1987) suggests that they had certainly made a direct impact on the local indigenous inhabitants by around 1705. This impact is evident in the historical artefacts that have been recovered from LSA sites in the area. At Elands Bay Cave three fragments of brass have been recovered from the uppermost units (Miller *et al.* 1998; Parkington & Yates, in prep. b), while at Tortoise Cave seven glass beads, one brass bead and a brass pendant, all of which are of the types normally associated with Europeans, were recovered from the uppermost deposits (Robey 1984; Miller & Markell 1993; Miller *et al.* 1998). These finds suggest a continuation of occupation after contact with Europeans. A scraper made on glass reported from one of the nearby deflation hollow sites (Parkington 1977) also suggests late indigenous occupation.

2.2.2 Geology of the area

South-western Cape

The rocks found in the south-western Cape are those of the Cape Supergroup, which is subdivided into the Table Mountain, Bokkeveld and Witteberg Groups. These rocks were deposited above rocks of the Vanrhynsdorp Group, the Malmesbury Group and the Cape Granite Suite (Visser 1989), and have, in turn, been overlain by rocks of the Karoo Supergroup. Although the Cape rocks are restricted in their exposure to the areas south and west of the Karoo, they do extend beneath rocks of the Karoo Supergroup. Small outcrops of Witteberg, Bokkeveld and Table Mountain Group rocks are present a little way into the Karoo (Winter & Venter 1970 in Truswell 1977).

The southern part of the Cape Supergroup, extending from the Worcester area into the Eastern Cape, is characterised by intense folding, whereas the western part, which runs north from Worcester and ultimately ends a little way north of Vanrhynsdorp, is characterised by gentle folding in the south and is unfolded in the north (Truswell 1977). The outliers forming the Piketberg Mountain and the Cape Peninsula are horizontally bedded (Visser 1989).

Most of the Table Mountain Group, which is the oldest of the three groups forming the Cape Supergroup, is composed of Peninsula and Nardouw orthoquartzites. These rocks are light in colour, well jointed, thickly bedded and resistant to erosion which results in them forming most of the major relief features in the Cape rocks (Truswell 1977). Altogether the Table Mountain Group is made up of eight different formations with five of them being divided into two subgroups as shown in Table 2.2 below.

Table 2.2 Stratigraphy of the Table Mountain Group in the Western Cape.

Subgroup	Formation*	Thick-ness [†]	Lithology
Nardouw	Rietvlei	150m	Fine- to medium-grained sandstone with pebble horizons
	Skurweberg	206m	Sandstone
	Goudini	120m	Sandstone and siltstone
Winterhoek	Cedarberg	120m	Fine-grained sandstone, siltstone and mudstone
	Pakhuis	40m	Sandstone, conglomeratic tillite, diamictite and shale
	Peninsula	1550m	Medium- to coarse-grained sandstones with thin layers of conglomerate
	Graafwater	150m	Interbedded sandstone, siltstone, mudstone, quartzite and conglomerate
	Piekenierskloof	390m	Coarse-grained sandstone with conglomerate at the base

*Youngest at the top. [†]Thickness according to Theron & Thamm 1990.

Sources: Tankard *et al.* 1982; Visser 1989; De Beer *et al.* 2002.

The continental shelf off the west coast of Southern Africa is wide and deep, but with much regional variation. The shelf tends to have a rocky zone some 8 km wide after which a steep drop of up to 70m leads to the broad, relatively featureless and gently sloping middle and outer shelf areas which are covered by Tertiary sediments (Dingle 1973). The geology and topography is variable with areas underlain by Malmesbury shales being smooth while rugged areas consist of Table Mountain Group sandstones, Namaqualand metasediments and granite (Birch *et al.* 1991). Due to the steepness and depth of the west coast continental shelf, relatively little area would have been exposed during Pleistocene low sea levels (Dingle 1973). In the region of St Helena Bay, however, bathymetric profiles show that the Holocene sediments forming the Olifants River delta have resulted in a relatively shallower area (Dingle 1973, Figure 3).

Elands Bay

The Piekenierskloof Formation is the oldest, and lowest formation in the Table Mountain Group and forms the mountains of the Elands Bay area. It contains significant amounts of

conglomerate which would quite likely have been an important source of raw materials to the Stone Age inhabitants of the area. Such pebbles are frequently very strong and homogenous, having usually survived long distance transport in turbulent river environments prior to their deposition (Board, pers. comm.).

The areas north and south of Elands Bay are rolling sandy hills with sporadic koppies consisting of rocks of the Table Mountain Group. The drainage of the area north of Elands Bay is controlled by three north-west-trending strike faults that have become river valleys, the southern most of which contains the Verlorenvlei River. This river would have flowed much further westwards through a deeper valley during times of lower sea levels, but the post-LGM sea level rise resulted in a rapid infilling of the valley (Rogers 1987).

The Piekenierskloof Formation extends to the south and east of Lamberts Bay reaching Piketberg at its furthest extent. It is characterised by a basal conglomerate with coarse sandstone above. Some geologists estimated the total thickness of this formation at about 800m (Rust 1967, Visser 1989), while others suggested that it varies from 550m in the region of the Olifants River Mountains to 230m at Piketberg (Visser & Theron 1973).

The formation is composed of two members, the conglomeratic Rest Member, and the sandy De Hoek Member. Rust (1967) notes that this division is oversimplified and states that much tonguing and gradation has occurred. The De Hoek Member seems to be thicker in the south-east with the Rest Member pinching out, while to the north-west the Rest Member is thicker and dominates the formation. The isolated and incomplete exposures of the Piekenierskloof Formation along the West Coast have resulted in the stratigraphy of the formation not being well known, although the differing vertical relationships of the two members indicate that

they were deposited simultaneously in different areas depending on the local circumstances. In some places the Piekenierskloof Formation is completely absent (Rust 1967).

The conglomerate, or Rest Member, “is a thick-bedded, profusely cross-bedded, open framework conglomerate with a sandy matrix, and a few beds of purple sandstone and shale near the base” (Rust 1967:22). This description, however, varies with locality. Visser and Theron (1973) point out that the pebble inclusions increase in size in a westward direction. Based on a measurement of 50 of the largest pebbles at Elands Bay, Rust (1967) determined their mean diameter to be about 61 mm. Vos and Tankard (1981), however, point out that in the basal unit, which is coarsest, pebbles of 10 to 15 cm are common and the occasional boulder of up to 40 cm diameter is even present.

The pebble inclusions in the conglomerate along the mountain south-east of Elands Bay vary from place to place, but primarily comprise vein quartz with the rest being quartzite of various colours (white, green, bluish-green, yellow, pinkish and grey), reddish sandstone and quartz-porphry, jasper, hornstone (volcanic ash), and black and banded brown chert pebbles (Rust 1967). At Groothoekbaai, 10 km north of Lamberts Bay, De Beer *et al.* (2002) report inclusions of as much as 15 to 30 cm in diameter occurring in places. Pebble composition in that area is primarily white vein quartz with, in order of abundance, grey quartzite, black chert, quartz schist, hornfels and jasper making up the remainder.

At Elands Bay the cliff at Baboon Point is formed by the De Hoek Member (Rust 1967) with the Klipheuwel Formation being exposed to a maximum of 3 m above sea level just west of the Elandia Visserye factories (Theron & Thamm 1990). This Klipheuwel Formation consists of mudstones, siltstones, medium- to coarse-grained sandstones and conglomerates

(Vos & Tankard 1981). Overall, these rocks become coarser and more conglomeratic towards the top, with the pebbly conglomerates – best developed near the contact with the Piekenierskloof Formation – overlying the silt- and mudstones that are more common in lower layers not exposed at Baboon Point (Vos & Tankard 1981).

All sands found in the area are of marine, fluvial or terrestrial origin and are of Tertiary to recent age. The marine component, extending some 7 to 13 km inland of the present coastline, is the result of a series of geologically fairly recent marine transgressions. The uppermost marine sediments are a succession of compact, poorly cemented sands and gravels that are associated with a series of raised beaches formed during Pleistocene sea level fluctuations (Carrington & Kensley 1969). Within these sands, silcrete, ferricrete and surface limestone occur very commonly, but altogether are of limited extent (Visser & Theron 1973). Further north though, especially along the Olifants river and on the sand covered coastal plain, De Beer *et al.* (2002) suggest that both silcrete and ferricrete are fairly widespread. The mobile dune sands occurring on the surface along most of the west coast are shelly aeolian sands dating to the Late Pleistocene and Holocene (Schloms *et al.* 1983). The current barrier dunes are late Holocene in age, while a large dune cordon further inland marks the mid-Holocene high sea level (Fromme 1985).

2.2.3 Environmental context and history

Climate

For the sake of convenience I have adopted the terms used by Mitchell (1988a) to summarise the climatic history of southern Africa during the period considered in the present study. Owing to the more general conclusions drawn by most writers, the focus in this section is

wider than just the Verlorenvlei area with the palaeoenvironments of much of South Africa being considered.

Upper Pleniglacial

This period, extending from about 25 000 to 16 000 BP, was the coldest period with mean temperatures being about 4 – 6°C, and in some parts of the interior plateau, even as much as 9°C, colder than today (Mitchell 1988a; Talma & Vogel 1992). A slow decrease in mean temperatures is evident, with the coldest period being between 19 000 and 17 000 BP, after which an increase began to take effect (Talma & Vogel 1992). Through climate modelling, Barrable *et al.* (2002) suggest that during the LGM the western Cape may only have been about 1°C cooler than today. Pollens from west coast marine sediments indicate a cold, arid period, and a northward shift of the winter rainfall area between 21 000 and 17 500 BP in the western parts of southern Africa (Shi *et al.* 2000). Evidence from Boomplaas Cave suggests that in the southern Cape the LGM was also drier (H. Deacon *et al.* 1984). Hedgehogs, which are found in areas with at least 300 mm of rainfall (Klein & Cruz-Urbe 1987; Skinner & Smithers 1990), wood charcoal and pollen (Baxter 1997; Cowling *et al.* 1999; Parkington *et al.* 2000) from the Elands Bay Cave deposits all indicate wetter conditions in that area during the LGM. Barrable *et al.* (2002), however, expect the west coast to have been drier then, with their explanation for the contradictory proxy data being that EBC, due to lower sea levels, was further inland, and slightly higher, such that rainfall there may have benefited by a greater orographic input. Thus it appears that while all areas were colder during the LGM, the western parts of the Western Cape were wetter than at present with the eastern area, and perhaps the Northern Cape coast, experiencing drier conditions. These conclusions are largely supported by the recent synthesis of Meadows and Baxter (1999).

Late Glacial

Between 16 000 BP and the start of the Holocene at around 10 000 BP the climate of the subcontinent ameliorated, with deglacial warming beginning about 15 000 years ago. The warming was quite rapid until about 11 000 BP when a sudden cooling associated with the Younger Dryas occurred. After this the warming continued (Tyson 1999; Tyson & Partridge 2000). Anatomical studies of wood charcoal from Boomplaas suggest the southern Cape Late Glacial to have been a relatively wet period with higher precipitation levels even than the Holocene (Scholtz 1986). Shi *et al.* (2000), however, find a period of aridity between 14 300 and 12 600 years ago in the pollen record for the western parts of southern Africa. After 12 000 BP rainfall began decreasing as temperatures rose (J. Deacon. 1988), with the micromammals from Elands Bay Cave indicating that the driest period was between about 10 000 and 8900 years ago (Avery, in prep.). The west coast pollens support a further dry period between 11 000 and 8900 BP (Shi *et al.* 2000). Despite this terminal Pleistocene dry spell, the presence of hedgehogs at both EBC and Faraoskop (Klein & Cruz-Urbe 1987; Manhire 1993) suggest that rainfall at that time may still have been higher than today. Although these animals are generally found in areas receiving between 300 and 800 mm of rainfall annually, they are not water-dependent (Skinner & Smithers 1990) and might, therefore, have survived in drier areas in the past. Their modern distribution, however, does not extend into this part of South Africa (Skinner & Smithers 1990).

Post-Glacial

During the first half of this period, the early to mid-Holocene, temperatures continued rising with the years between about 7000 and 4500 BP, known as the Holocene altithermal, being about 2°C warmer than today (Heaton *et al.* 1986 in Partridge 1997; Tyson & Partridge 2000). While the northern parts of the subcontinent received higher rainfall during the mid-

Holocene (Partridge 1997), the south-western Cape is thought to have been drier (Cockcroft *et al.* 1987; Meadows & Baxter 1999). While the Boomplaas fauna reflect a warmer mid-Holocene (H. Deacon *et al.* 1984), the Cango stalagmite shows temperatures depressed by about 2°C from 5000 to 2500 BP, with two main cold periods focussed between 4700 and 4200 BP and between 3200 and 2500 BP (Talma & Vogel 1992; Tyson 1999). The stalagmite also shows temperatures to have been about 1°C warmer than today at about 2000 BP (Talma & Vogel 1992). There was much regional variation in rainfall at this time with some areas receiving more and others less than present levels (Tyson & Partridge 2000). Tyson (1999) summarises the work of numerous researchers showing that temperatures over the last 3000 years have been quite variable with numerous periods of warming and cooling. A particularly warm event occurred between 1950 and 1600 BP, while a prolonged cold spell, known as the 'Little Ice Age', occurred between AD 1300 and AD 1810 (Tyson 1999).

Throughout much of the Holocene, and especially between c. 8000 and 4000 years ago, the Elands Bay area was probably a fairly marginal environment. This may well be due to its location at the northern extremity of the winter rainfall area of the south-western Cape, which would have made it more susceptible to palaeoclimatic change (Parkington *et al.* 1988). Parkington (1984) suggests that the aridity gradient may have shifted up to 300 km south making the Elands Bay area rather arid at that time. Pollen samples indicate aridity during the mid-Holocene and Meadows *et al.* (1996) suggest that these dry conditions are likely to have been a major cause of the occupational hiatus experienced around Elands Bay at the time. Butzer (1983), however, suggests that the early Holocene was drier at the coast and moister inland, while the mid-Holocene was slightly wetter at the coast and drier inland.

Sea levels

The south-western Cape coast has a sedimentary and geomorphological record reflecting many marine transgressions between tertiary and recent times. This fluctuation relates to the repeated formation and subsequent melting of northern hemisphere ice sheets, resulting in changes of ocean volume (Tankard 1976; Miller 1990). From the Last Interglacial about 120 000 years ago, the sea level progressively decreased until the minimum level of about 130 m lower than the present mean sea level (MSL) was reached during the LGM, around 17 000 BP. After that it rose to its present level with a brief transgression of the current mean during the mid-Holocene.

From a series of available radiocarbon dates, Miller (1990, figure 1) has postulated a relatively rapid rise in sea level from the LGM into the Holocene. This may have been interrupted by a period of relatively slower rise during the last few millennia of the Pleistocene (van Andel & Lianos 1984, Figure 8; Ruddiman & Duplessey 1985; Edwards *et al.* 1993). After this there was another relatively rapid rise during the early Holocene tapering off to about 2m above present MSL at c. 5000 BP (Miller 1990). While little work has been done on the local post-glacial sea level rise, a rapid rise is well attested to in other parts of the world from the LGM until the early mid-Holocene. From sediment cores in south-east Asia and coral reef studies in Tahiti and Barbados, a large and rapid jump in sea level is suggested sometime between 14 600 and 13 800 BP, with another at c. 11 300 BP (Fairbanks 1989; Bard *et al.* 1990, 1996; Hanebuth *et al.* 2000). Rapid early Holocene sea level rise has also been documented from coral reefs in New Guinea (Chappell & Polach 1991). Whatever form they took, these changes in sea level are reflected by the faunal remains from Elands Bay Cave. Shellfish first appeared in EBC about 11 000 years ago and by 9000 BP true shell middens were accumulating in the cave (Parkington 1988, in prep. c).

Fish bones are present in very small numbers from about 13 000 to 11 000 years ago, but become very numerous after this time, while other marine elements such as seals, crayfish and sea birds are common after 10 000 BP (Poggenpoel & Parkington, in prep.). Studies at Langebaan Lagoon, 80 km south of Elands Bay, have suggested that the rising sea levels first transgressed the modern MSL at least 6500 years ago (Tankard 1976; Flemming 1977; Compton 2001).

Baxter (1997), however, proposes a Holocene sea level curve somewhat different from the above suggestions. He considers the sea to have risen rapidly, to within about a metre or two of the modern MSL some 8000 years ago, and then subsequently regressed by about 3 to 4 m allowing sand dunes to form along the southern edge of the vlei about 6500 years ago. This was followed by another rapid recovery and a few relatively minor oscillations, leading to the well-documented mid-Holocene high sea level.

The 4000 BP sea level is likely to have been about 2 m higher than present (Yates *et al.* 1986; Jerardino 1996; Baxter 1997), and sediment cores from the upper reaches of the Verlorenvlei suggest an estuarine environment there between about 5000 and 4300 BP (Meadows *et al.* 1996). Recent research, however, suggests a more rapidly falling level with a possible regression some 4800 years ago and brief transgressions just before and after that date (Compton 2001). A series of minor regressions and transgressions are suggested for the last 4000 years, with none likely to have been more than 1 m below or above present MSL (Jerardino 1996; Compton 2001).

It is likely that the emerging coastline just after 3800 years ago resulted in the flat, highly productive mussel-rich reefs becoming more and more exploitable by hunter-gatherers. It is

thought that this might have been the factor that initiated the deposition of the megamiddens occurring in this area. Later, the subsequent sea level rise towards the present mean resulted in sites associated with these reefs after 1700 BP having higher frequencies of limpets (Yates et al. 1986) as people perhaps began making use of alternative collection areas such as the north-facing sheltered shore of Elands Bay where limpets are far more common (Parkington, pers. comm.). Baxter (1997) also sees a minor transgression around 1500 BP.

Changing sea levels would have had implications on human settlement by virtue of the fact that marine food resources are concentrated in those areas where rocks are present at the coast. There may have been some effect on raw material collection, although this is likely to have been small, since most stone was probably collected from river gravels and conglomerate bands in the Table Mountain Sandstone.

Verlorenvlei

The Verlorenvlei exists due to the presence of a sandstone rock bar blocking the mouth approximately 1m above sea level (Tankard 1976; Tinley 1985) and must have been an important source of water in the past. As a result of the bar, little input of sea water occurs, although during storm surges the sea occasionally washes over into the river mouth. The Verlorenvlei is regarded as a coastal lake and is about 13.5 km long with a channel of some 2.5 km between the open vlei and the ocean. Its depth averages 2.5 m but reaches 5m at the deepest point (Fromme 1985; Tinley 1985; Sinclair *et al.* 1986).

Much of the catchment area lies over Malmesbury rocks and one stream flows over limestone in the southern area. Salts leach out of these rocks into the water such that the water entering the vlei is already slightly brackish, but the salinity still increases steadily as one moves

downstream (Robertson 1980). By the South African standards of less than 2.0 parts per thousand of salt, the lower third of the vlei (estimated from Robertson (1980, Tables 2.1 & 2.2)) is never suitable for human consumption, while the entire body of water is too saline to meet the international criteria. This must have meant that prehistoric people may have had to travel upstream from the mouth to obtain water of a reasonable quality. With changing sea levels in the past though, the Verlorenvlei River would have contained better quality water at times of lower sea levels and undrinkable water during the mid-Holocene high when the sea flooded a considerable way up the valley.

Final formation of the Verlorenvlei valley would have taken place during the last Ice-Age when sea levels were much lower. The valley would have been deeper then with the subsequent Holocene sea level rise having caused it to silt up, eventually becoming the lake that it is today (Miller 1986).

With the mid-Holocene raised sea levels, an abrupt slope break was carved by tidal energy along the south bank of the Verlorenvlei, a few tens of metres from the current shore (Miller 1987), testimony to the fact that the vlei would have been a fully open estuary until about 2000 years ago (Rogers 1987). As the sea level dropped, the modern beach and its attendant barrier dunes would have been created (Fromme 1985). An older, deeper mouth channel was uncovered just north of the present one during excavations for the railway bridge (Tankard 1976), This palaeo-channel would have formed with the lowering sea level and is expected to have led straight to the sea before being pushed steadily southwards to its present location by the development of the recent barrier dunes over the last 4000 years (Fromme 1985; Baxter 1997). It is thought that this earlier channel would have functioned as a tidal inlet.

Dunefields

Southern African littoral dune cordons are thought to be mostly Holocene in age with many cordons occurring further from the beach considered to be older (Tinley 1985). Radiocarbon dating has shown dunes in the Eastern Cape to be Holocene in age (Illenberger & Verhagen 1990), while the large cordon extending north-north-east from Elands Bay is said to have formed during or after the mid-Holocene high stand of the sea (Fromme 1985; Miller 1987), probably also from about 6500 BP (Baxter 1997). The sediments would have accumulated as a result of changes in sea levels and local climates (Barwis & Tankard 1983), with lowering sea levels exposing sand which became mobile as it dried out (Tinley 1985). Both short and long term sea level fluctuations are known to have significantly influenced sand supply to beaches and, therefore, coastal dunes (Wilson & Braley 1997).

Illenberger (1988), based on a study of the Algoa Bay dunefields, sees the Holocene sand supply and resultant dune formation as being irregular with a first pulse of deposition beginning about 6500 years ago, after the sea had recovered to around present levels. This was followed by second and third pulses starting about 3500 and 1200 years ago respectively. Climatic fluctuations are also thought to have played a part in this pulsing supply and would have been mainly temperature and moisture changes (Illenberger 1988). It is suspected that variations in wind energy might also have played a role (Illenberger & Verhagen 1990).

Manhire (1987) recognised and attempted to answer two questions with regard to the deflation hollow sites located in the sandy areas around and to the north of Elands Bay. Firstly, he sought to find out whether the deflation pattern was of recent origin, and secondly, whether conditions in evidence today are similar to those that existed during the time of prehistoric occupation. While admitting that it is impossible to obtain definitive answers to

either question, Manhire suggests that, in the 'Death Valley' area where a dune monitoring programme was conducted, much of the dune activity is of relatively recent origin.

For plants to be successful in restricting dune movement, annual precipitation needs to exceed about 100 to 300 mm (Goudie 1992). Although these figures are not local, they are likely to represent a good approximation for southern Africa with variation based primarily on locality and wind (February, pers. comm.). The Sandveld dunefields are thus in a state of equilibrium in which erosion and deposition are delicately balanced (Heydorn and Tinley 1980). These dune systems are very easily disrupted by changes to the natural order and Manhire (1987) suggests a sequence of events involving such changes related to European settlement.

The dunes are likely to have been in a state of plant-induced relative stability which was disturbed by the repeated grazing, burning and woodcutting that took place with the advent of regular farming in the area some 200 years ago. This would have resulted in the deflation of the hollows evidenced by the reduction of all prehistoric occupations in each hollow to a single horizon following the upward curve of the edges of the hollows.

It is unlikely that active deflation hollows would have been occupied, or that the hollows have been continuously deflating since prior to LSA occupation. Lancaster (1986) suggests that the current phase of erosion is a renewal of the process that originally created the hollows prior to occupation. One would assume, therefore, that occupation took place while the hollows were in a relatively stable condition and were able to provide some degree of shelter from the wind.

Fauna and flora

Large grazing mammals from Boomplaas and Nelson Bay Cave (NBC) indicate the presence of grassland vegetation in the southern Cape between 21 000 and 12 000 BP, while a strong change to browsing fauna is evident between 12 000 and 10 000 BP (J. Deacon 1988). In the western Cape, a similar change has been documented for Elands Bay Cave sometime between c. 9000 and 8000 BP (Parkington 1980a, 1987), and for Faraoskop before about 10 000 BP (Manhire 1993). Charcoal and pollen from EBC suggest that more woody trees were present at the LGM and that the vegetation was generally more diverse than at present (Baxter 1997; Cowling et al. 1999; Parkington *et al.* 2000). The change in dominance from grysbok to steenbok at EBC some 9600 years ago is taken to imply a shift in vegetation from typical fynbos vegetation to coastal strandveld (Klein & Cruz-Uribe, in prep.). The micromammals from EBC, however, indicate more closed bush and scrub between 10 000 and 8900 BP with more grasslands just before then (Avery, in prep.).

At Boomplaas the shift to browsers is followed by a dominance of small, non-gregarious browsers until sheep appear in the deposits at about 1800 BP. Only from about 6500 years ago do we see modern fauna and flora at Boomplaas (J. Deacon 1988). While EBC was unoccupied during the mid-Holocene, the faunal record of the last four millennia reflects modern patterns (Parkington 1980a). The micromammals suggest the flora to be dominated by grasses during the mid-Holocene (D. Avery, in prep.), while a sediment core from the upper Verlorenvlei also suggests mainly grasses from c. 5000 BP until just after 4300 BP with few major fynbos elements and woodland species. A further core reveals the impact of overgrazing and anthropogenic disturbance over the last few hundred years (Meadows *et al.* 1996). Baxter (1997) suggests the modern Sandveld vegetation to date back to around 6500 years ago.

2.2.4 Previous lithic research

Although studied quite extensively for the European Middle Palaeolithic (e.g. Rolland & Dibble 1990; Dibble & Rolland 1992; Otte 1992; Dibble 1995; Kuhn 1995) and less so for the Upper Palaeolithic (e.g. Thacker 1996), the effects of raw materials on lithic assemblage variability have not been examined much in the Western Cape specifically, or southern Africa in general, although the total extent of all archaeological research in the subcontinent is substantial. A number of studies of tool type variability have been conducted, but very seldom has the specific influence of raw materials on tool type distributions been examined. Some of these studies are discussed below.

Much other work of a more general nature has been done on the lithics from the various sites in the area. Included in this work are various stone artefact analyses, many of them the product of undergraduate and post-graduate research projects (e.g. Wadley 1973; Feitelson 1975; Petigrew 1977; Sievers 1977; Mazel 1978; Horwitz 1979; Davis 1980; Manhire 1984; Robey 1984; Siegruhn 1989; Vermeulen 1990; Reeler 1992; Wahl 1994; Jerardino 1996; Orton 1998). Various articles dealing with these and other lithic analyses have also been published (e.g. Noli 1986; Manhire 1987; Robey 1987; Parkington *et al.* 1992; Jerardino 1997; Orton 2002), while a detailed work on Elands Bay Cave is currently in preparation (Parkington, in prep. a).

Rudner and Rudner (1954), in their study of the archaeological sites of the south and west coasts of the Cape, suggested that coastal dwellers had different needs to people living inland and as a result used only certain items of their usual toolkit. Essentially those tools that were required more frequently at the coast would be present in higher frequencies on coastal sites.

In particular their concern lay with the many 'slugs', or 'adzes' as they are now known, which they found associated with these coastal sites. They termed such sites 'Sandy Bay', ascribing them to the Smithfield and declaring them to be a late, and locally restricted development of the late Smithfield Culture. They supposed that the adzes' primary function might have been for working bone or ivory and possibly also wood. Their use in the working of wood has been confirmed through the comparison of use wear on prehistoric and experimental adzes (Binneman & J. Deacon 1986).

Sampson (1974) noted that some southern Cape coastal sites showed identical subsistence activities, but actually had different stone tool assemblages. He concluded from this observation that differences in stone tool assemblages must have been cultural rather than activity related, suggesting that Wilton-type assemblages were made by Bushmen and those resembling the Sandy Bay assemblages by Strandlopers. Such interpretations are outdated, since we now know that the range of lithic assemblage variation found on southern African LSA coastal sites is considerable.

Mazel and Parkington (1978) found adzes to be in abundance on inland sites around the Olifants River valley and countered the suggestion of the Rudners (1954) that adzes were a tool type required more often at coastal sites. Working inland at Andriesgrond and De Hangen, Mazel and Parkington (1978) found adzes in association with woodshavings and wooden tools, while Manhire (1993) also found these items associated at Faraoskop in the Sandveld. This seems to be a further clear indication that adzes were used in woodworking. Mazel and Parkington also found adzes at a number of other sites in the area, concluding that they were obviously not related to the coast but rather to the fact that woody fynbos shrubs, offering sticks suitable for working, were located nearby. It was suggested that the sites

examined and discussed by the Rudners, although being coastal sites, in fact had an abundance of adzes because they were located near to the mountains of the Cape Peninsula and False Bay area.

The only other study into stone tool functions was conducted by Parkington and Binneman (n.d.) on the naturally backed knives from the terminal Pleistocene levels of Elands Bay Cave. Microwear studies showed these tools to have also been used on wood.

In a later study Mazel and Parkington (1981) examined the relationship between tool types and resources in the Western Cape, arguing that activities undertaken on a site were a reflection of the resources in the area around that site. From the viewpoint that the site occupants would have required only those tools needed to exploit or process those resources, they argued that the tool type variability between sites was a reflection of the resources available to the makers and users of the tools at each site. By implication then, if resources were to change in an area, possibly due to an environmental shift, the tool type patterns over time would reflect this change.

An earlier paper by Parkington (1980b) argued that both 'place', defined as being "the set of opportunities offered by the location and thus the likelihood of particular activities taking place there" (Parkington 1980b:73), and 'time' had determining effects on stone tool assemblage composition. Stone tool assemblages must therefore reflect both tradition and activity. Parkington differentiates the two by saying that activity-related assemblage features would not be found in contrasting areas, while tradition-related features would only be found as far as the extent of those cultural boundaries.

Parkington *et al.* (1988) include a short discussion on raw materials in their paper on coastal settlement. They mention the issues surrounding sourcing of non-local materials and whether they were traded or accessed directly by coastal inhabitants. The distinct shift in raw material use, which occurs around 9000 BP at Elands Bay Cave and at later dates in other Western Cape sites, is pointed out. The use of non-local raw materials diminishes considerably in favour of local materials. Quartz, however, maintains its dominance throughout. These changes in the raw material composition of assemblages are taken to indicate that later people appeared to have more limited access to non-local raw materials, possibly due to a breakdown in exchange relations and/or restricted group movements.

In summary then, lithic research in the Western Cape has shown there to be much inter-site variability both between sites located in similar areas and between coastal and inland sites. Research into tool functions has been limited to adzes and naturally backed knives with the conclusion that both were used in woodworking. The functions of other tools are generally inferred from the various studies conducted elsewhere. It has been suggested that the range of tools recovered on sites reflects the range of resources located in the area around it, since only those tools needed would have been produced. Some influence from cultural tradition, however, is also expected. Changes in raw material proportion have been considered to relate to mobility and/or exchange with the presence of non-local materials suggesting an increase in one or both factors.

3 THE RESEARCH

3.1 SCOPE OF THIS RESEARCH

3.1.1 Lithic assemblage variability

The primary variability dealt with here revolves around the variations in raw material proportions that are evident in the assemblages of the study area. The second type of variability considered is that in the formal tool, edge-damaged, core and débitage categories within each raw material. Variation through space is limited and the focus is therefore on temporal change, especially within the three particular periods mentioned in Chapter 1.

The range of raw materials present in these assemblages includes quartz, quartzite, silcrete, sandstone and other scarce and less frequently used materials, such as cryptocrystalline silicates (including chert), hornfels and the occasional igneous rock, which are not locally and/or abundantly available. Clear changes in raw material use over time are apparent with a major reduction and subsequent increase in the use of locally common materials spanning the Pleistocene-Holocene transition. Although assemblages were always quartz dominated, the contributions from other materials were substantially larger around this time.

Besides edge-damaged flaked artefacts, cores and large quantities of débitage, including chips, chunks and flakes, lithic assemblages contain a wide selection of tool classes with backed bladelets, various scraper forms and miscellaneous retouched pieces comprising the majority. Other flaked tools present in smaller numbers include adzes and a few other types of backed tools, such as segments and borers. It is frequently the case that LSA assemblages are dominated by very few formal tool classes, a pattern also noticed in the European Upper Palaeolithic (Sackett 1988 in Grayson & Cole 1998).

Although this research deals only with flaked artefacts, various other items help make up the total lithic assemblage. Among these are utilised manuports such as grindstones, anvils and hammerstones, as well as unutilised manuports, frequently in the form of pebbles, which are usually assumed to be unused raw material, either meant for utilisation or flaking. Lumps of ochre and other pigment materials are also found.

3.1.2 Factors affecting variability

There are many factors indirectly affecting the size and composition of an assemblage by virtue of the fact that they have an effect on the activities for which tools are required. Ultimately, variation in assemblage composition “is directly related to the form, nature and spatial arrangement of the activities in which the tools were used” (Binford & Binford 1969:78), although this is only one of a series of inter-linking factors.

Probably the most important set of factors is the proximity to and distribution of the various resources and raw materials required by the inhabitants of a site, although other raw material factors, such as size, quality and quantity of the available stone (Dibble 1995) and the way in which it fractures also played a role. Prevailing environmental conditions (Binford & Binford 1969), group movements (Rudner & Rudner 1954, Parkington 1986b), size, structure, and ethnic composition (Binford & Binford 1969) would all have had some effect on the activities carried out at a site, while technological innovation (Parkington 1986b) would have determined what tools could be made and how.

Another interesting factor is raised by Thacker (1996), who points out that the reduction of blade cores results in fewer of these cores and a greater number of bladelet cores. Blade-rich

assemblages are therefore likely to have less blade cores than bladelet cores due to their reduction to the latter as the blades removed become shorter, eventually dropping below the 25 mm threshold of bladelets (see Section 3.2.2). In the Elands Bay research area, similar reduction is likely to have affected all types of cores and resulted in the production of bipolar cores, which are the logical end product. There are not many instances in which a second phase of reduction would lead to a change in classification of the artefact, but this scenario is also possible when artefacts are curated and modified, with adzes and scrapers being the most likely artefacts affected when they are reduced by resharpening such that their overall shape changes. Aside from this, new tool types might be made from already modified flakes that are still perfectly good for the manufacture of new tools. For example, a backed bladelet might be reworked into a borer, although we are unlikely to be able to detect this reworking.

Late Pleistocene group movement may well have caused people to move across areas containing different sets of raw materials. Parkington (1984) has suggested that if they moved from the hornfels-rich interior of South Africa to the mountain and coastal regions of the Cape, it is quite likely that they would produce a technologically and typologically different assemblage with the raw materials available in the mountain and coastal areas. He goes on to say that if this movement were to happen then “some accommodation to raw material distributions would have been necessary and some expedient manipulation of, or improvisation with, locally available but unfamiliarly tiny pieces of quartz seems inevitable” (Parkington 1984:128). He also suggests a variation on this scenario that would see the coastal and mountain dwellers as marginal population groups that had adapted technologically to the lack of hornfels and abundance of quartz. The current research area is not large enough to test this though.

Many workers distinguish home base camps from work camps. Binford & Binford (1969:71) expect the former to contain tools which reflect what they call “maintenance activities: the preparation and consumption of food and the manufacture of tools for use in other less permanent sites”. Work camps would contain only tools used in “specific extractive tasks” and if a larger group occupied such a site for a longer period than a few maintenance activities would also be reflected. They also argue that the further the work camp is from the home base, the more likely that maintenance tasks would have been performed. In terms of Parkington’s (1977) model of seasonal mobility across the Western Cape landscape, different assemblages might be evident according to whether the people creating the sites were living on the sites, staying there for a few days or weeks, or perhaps just passing through the area and merely making an overnight camp.

Going one step further, one can attempt to identify the activities that took place at different sites. Some sites will have a wide range of activities, and hence a wide range of tool types, while other sites will be far more narrowly focussed in terms of the activities that were taking place there. Relatively long-term residential sites, which would be expected to show a wide variety of activities, are generally assumed to contain a wider range of tool types, while in camp sites reflecting a brief occupation, we would find a relatively low diversity of tools. While this dichotomy is blurred at the coast due to the general occurrence of lower tool frequencies there, Dunefield Midden 1 (Orton 2002) is a good example of a campsite where, with the exception of miscellaneous retouched items, only two primary tool types were made. Similarly, Wadley (1987) has shown that aggregation sites might be expected to contain many more retouched tools and a wider array of raw materials than dispersal sites.

While most of the factors above are aimed at explaining the variation in artefacts, there is also variation in raw material proportions, something with which this research is primarily concerned. Although raw material availability and functions for which tools were required are obvious sources of variability among materials, cultural preferences for certain stone types may also have guided raw material selection. The white colour of the stone used in a Tswana context at Madikwe is thought to have been significant (Hall 2002b), while ethnographic sources indicate that white stone was preferred for arrowheads (Wadley 1987). A major shift in raw materials is apparent at several sites in the Eastern Cape with little or no concurrent change in tool types (Hall, 2000a; Leslie-Brooker, 1987), possibly a cultural phenomenon. In the western Cape, however, we find certain tool types always, or at least preferentially made on certain materials or groups of materials (Manhire 1987) suggesting that no overall preference existed. It is perhaps only in assemblages in which two or more materials play significant roles that raw material suitability becomes important. KN6-3C (Halkett 2003), with quartz and cryptocrystalline silica comprising 68 % and 31.3 % respectively, may be an example. In this assemblage the latter material is strongly preferred for formal tools, and indeed, all the drills and borers are made on it (own data).

Of course the home range frequented by the toolmakers would have a considerable influence on what raw materials could be collected and hence be available for use. Since it is known that Holocene people were more territorial and sedentary than earlier people (H. Deacon 1972; Mitchell 2003), we should expect to find some reduction in the range of less common materials present in assemblages at this time. Unfortunately, it is very difficult, if not even impossible, to accurately assess the availability of raw materials for the whole history of long-sequence occupation sites. At Elands Bay this factor is complicated by the Late Pleistocene sea level rise, which may have covered raw material sources.

Another difficulty arises with the ever-present complicating factor of raw material scavenging, whereby materials are collected in the form of existing artefacts and taken back to the home site. This results in a mixing of artefacts which may not be evident to the analyst. Although we can frequently recognise the classic MSA flakes and other large flakes and blades that may have been collected as random occurrences on the landscape, or perhaps scavenged from MSA sites, other items may have been used as raw material or modified in such a way that they are no longer recognisable as MSA pieces. Fortunately, with so few known MSA occurrences in the Elands Bay area, and only a handful of clear MSA flakes incorporated in the current sites, these artefacts' contribution to LSA assemblage variability is likely to have been minimal. Most artefacts, and especially the small débitage pieces, are technologically adiaagnostic thus rendering impossible the task of separating those artefacts which may have been produced elsewhere and at an earlier time from those produced on site. In the strictest sense, such collected artefacts should be regarded as manuports since they would distort the true proportions of the flaked artefacts made on the site and hence our understanding of the decisions taken by the stoneworkers. At Dunefield Midden 1 this separation has been made easy by the considerable weathering of some artefacts. This distinction proved critical in the interpretation of the site since it was possible to identify two vastly different assemblages (Orton 2002).

While all the above constitute sources of 'natural variability', one should also consider the possibility of variability within the context of excavation and analysis. Analytical variability occurs when application of artefact definitions changes, either over time or between analysts. This primarily affects flakes and chunks, since flake definitions often vary. Spatial organisation will vary from one site to another and from one layer to another, possibly inspiring variable interpretations for each layer. Furthermore a site will only reflect part of a

particular group's total subsistence activities and we only excavate part of each site. As such our choice of where to excavate could introduce significant variability which is beyond our control. Variations in temporal origins of the material in a layer will also affect variability. Some may be the result of a few days of intensive occupation during which large quantities of shell may have been introduced, while others, perhaps most notably before about 11 000 BP, may be the resultant accumulated deposit of many years worth of possibly quite sporadic occupation during which there may have been seasonal variations in activities carried out at the site.

3.1.3 Methods

The initial task was the selection of the research area. With such high levels of occupation recorded in certain parts of the Western Cape, it is beyond doubt that much of the area must have been occupied at some time or another. The selection of the Elands Bay vicinity as a research area was based on the fact that a particularly high density of recorded sites exists and extensive fieldwork has already been conducted there, with numerous excavated assemblages thus being available for study. In order to maintain manageability it was initially decided to restrict the research area to sites falling within approximately ten kilometres of the mouth of the Verlorenvlei River. Initially every assemblage that was available for study within this area was considered. Certain selection criteria had to be implemented, however (see Section 4.1 below), and when the final selection of sites had been made, all those incorporated ended up being within approximately 3 km of the river mouth.

It was hoped that the available sites would give a good variety of spatial and temporal glimpses into the past, but in practice this was difficult to achieve due to the sporadic and

discontinuous occupation of many sites in the area. Elands Bay Cave, the only site in the vicinity with Pleistocene deposits, provided many assemblages from throughout the LSA and those included were chosen on the basis of assemblage size and/or temporal positioning. Further detail on the selection of sites and assemblages is contained in Chapter 4.

No new sites were excavated for this project, although further excavation at the site of Dunefield Midden 1 was undertaken in December 2001 in a combined research effort with Tobias Tonner who was also working on that site at the time (Tonner 2002).

All the assemblages are analysed broadly following the system devised by Janette Deacon (1984b), but incorporating various revisions and additions which are discussed in section 3.2 below. Most assemblages had been analysed at least once before so it was only necessary to standardise these analyses by means of a quick re-examination in order to ensure that similar classes and raw material identifications were used for all sites. This was found to be meaningful as a number of changes had to be effected. A light microscope offering 7x to 40x magnification was used in the analysis to assist with the identification of features on some of the artefacts. This was particularly useful for the quartz artefacts on which it was frequently difficult to identify the defining features with the naked eye.

During the lithic analysis all artefacts were separated into the finest class divisions with the exception of the edge-damaged pieces which were left as a single class. In retrospect it may have been more suitable to separate these into the same classes as used for débitage so that a more detailed analysis of their typological composition could have been performed. This would have allowed a greater understanding of the decisions made by people concerning which pieces to use without retouch. Although miscellaneous retouched pieces (MRPs)

contain a variety of forms, these are always non-standardised and are deemed to be incomplete or very unusual, hence resulting in no distinction being drawn here either. A full study of MRPs is necessary in order to explore this variation, but this falls outside the scope of the current project. Once all results had been tabulated, they were examined graphically in order to identify trends in artefact manufacture and raw material use.

3.1.4 Constraints

The greatest impediment to the research resulted from the very limited temporal distribution of sites within the research area. Section 2.2.1 details the occupational history of Elands Bay showing the dramatic increase in sites during the last two millennia and the considerable dearth of occupation at times during the LSA. As a result, tracking assemblage change is complicated, since large chunks of the prehistory of the area are essentially missing, while majority of the remainder is represented by only one site. Resolution of the problem is difficult, since it is highly improbable that further sites with deep occupations will ever be located in the immediate vicinity. With Tortoise Cave reflecting a similar mid-Holocene hiatus to Elands Bay Cave (Robey 1984, 1987), other sites in the area may do the same and thus be unlikely to change the situation anyway. It has been suggested, however, that further excavations of known sites could possibly produce a few more older assemblages (Parkington *et al.* 1988). During August 2003, while exploring the cliffs some 100 m south of Elands Bay Cave, Brian Stewart and I encountered a small rock shelter with contents which appeared suspiciously similar to what would be expected from a Late Pleistocene occupation. Both the surface scatter and an animal burrow at the rear of the shelter yielded only tiny quartz artefacts in a very dark, moist deposit with no shell whatsoever. Due to its small size, this site is unlikely to contain significant depth and the deposit currently remains untested.

Spatial representation in the earlier part of the LSA is also severely limited with no known open sites dating before the mid-Holocene. Unfortunately, the extensive sand bodies north of the Verlorenvlei River are likely to have buried many sites which we are unlikely to ever locate. As a result, geographic explanations for coastal inter-site assemblage variability are unlikely to ever be conclusive prior to about 3500 BP. By way of example, during recent work on the Northern Cape coast (Halkett 2003), a mining trench of approximately 250m by 30m was found to have exposed some fifteen subsurface shell middens ranging in age from the mid-Holocene through to the pottery period. Only two other sites were visible at the surface within about 40m of the trench.

Marine transgressions and regressions are a major determining factor with regards to the location of sites available for study. Since the greatest concentration of open sites is typically very near the seashore, lower sea levels in the past would have resulted in most sites being located in areas that are now submerged. Workers in other parts of the world (e.g. Gifford 1983; Larsson 1983) have shown that artefact scatters and even *in situ* material can be located and excavated below current sea level, so the recording of submerged sites is not completely impossible. With the coast offering a relative wealth of resources, people would probably have been reluctant to walk great distances from the coast unless to a living site that was really worthwhile, such as Elands Bay Cave or Steenbokfontein Cave (to the north). This would explain the absence of sites along the present coast for the early part of the period under consideration. Open shell middens only appear in the Elands Bay archaeological record from about 3000 years ago, although we know that the coast was exploitable back to at least 10 000 years ago from this area due to the presence of the first shell middens in Elands Bay Cave at this time (Parkington 1988, in prep. c).

Spatial representation is also likely to be affected by recent human activities. Several sites have been disturbed in Elands Bay as a result of urban development, although it is thought that not many would have been lost entirely (Parkington, pers. comm.). In the surrounding areas farming would have had an impact, perhaps most especially on the deflation hollow sites of the Sandveld. To this effect, Manhire (1987) suggested that many hollows were artificially reclaimed such that the archaeology became buried by wind-blown sand.

Even without the problems described above, failure to adequately sample a representative selection of available assemblages can lead to spurious results. Since most of the sites used in this research are located on or very near the mountain, it is assumed that the spatial distribution of these sites will be fairly real since such sites are unlikely to be destroyed. As such, as many assemblages as has been possible and practical have been examined. Any spatial or temporal gaps that do exist are therefore likely to be relatively real phenomena.

A further fairly significant constraint is the fact that many of the sites within the research area, including Elands Bay Cave (Parkington 1977), were excavated using only a 3 mm mesh sieve. Today, and indeed since the late 1980's and early 1990's, the use of a 1 to 1.5 mm sieve has become standard in the western Cape. This allows the ostrich eggshell beads and many tiny stone chips which fell through the 3 mm mesh to be retained in the sample (Halkett 1990, pers. comm.).

In some sites, especially quartz-rich sites where the bipolar technique has been used extensively, as many as 50% of the lithics can be chips (e.g. Dunefield Midden 1 (Orton 1998, 2002)). Many of these would have been lost through a 3 mm sieve causing distinct biasing of the artefact counts. It has also been suggested that sorting was focussed differently

in the past and that the smaller chips were not always all collected (Yates, pers. comm.). This latter problem is particularly evident in the Elands Bay Cave assemblages where excavations were conducted through the 1970's. At this site it is quite clear that almost all the chips present are in excess of about 6 or 7 mm maximum dimension whereas all chips down to approximately 3 mm in size would have been expected in the samples had a detailed sort been conducted.

Another problem is the possible miss-identification and subsequent lack of recovery of chips, which can lead to a gross under-representation of this numerically large class of tiny artefacts. I have found that CCS chips bear great resemblance to minute shell fragments (especially *C. meridionalis*) when lying side by side in a sorting tray and that the tiniest crystal quartz chips are virtually invisible without the aid of direct sunlight which causes them to sparkle. This was shown experimentally during recent excavations on the Northern Cape coast at a site (KN6-3C) with significant proportions of both quartz and CCS. The fine fraction (that which passed through a 3 mm but not a 1.5 mm mesh) of every excavated unit was sorted by myself and, as a test, two of the relatively lithic-rich units were given an extra rigorous sort to determine the proportion of chips likely to be overlooked and discarded during regular sorting procedures. Table 3.1 shows the proportions of chips in quartz and CCS recovered in these two units as well as the mean values for the rest of the site which underwent a regular sort. I always try to maintain a very high standard of sorting, and bearing this in mind the data suggest a potentially alarming situation with respect to the relative recovery of chips.

These figures suggest improvements in the recovery rates of quartz and CCS of 68.4 % and 111.7 % respectively. Overall an average improvement of 76.44 % was experienced and

extrapolating this would suggest a possible total for these two materials of 3727 artefacts, of which 2292 would be chips. The differential recovery of quartz and CCS in this example has serious consequences for the raw material proportions at this site, since more CCS chips are being excluded than those of quartz. As a result CCS frequencies are artificially lowered. Taken together with the inconsistencies of sieving and sorting mentioned above, it was deemed necessary to perform the analyses with all chips excluded from the totals. As appropriate, however, the data were presented in a manner that allows comparisons to be made either with or without the inclusion of the chips. Bipolar experimentation on good quality vein quartz produced similar proportions of chips confirming that real chip proportions are likely to always be near 80% with this flaking technique (See Appendix 1).

Table 3.1 Quartz and CCS chip recovery rates.

	Total Qtz	% Qtz chips	Total CCS	% CCS chips	Total artefacts	Total % chips
Regular sort	1809	50.53	791	36.54	2600	46.27
Extra thorough sort	114	85.09	93	77.42	207	81.64

The variability within deposits discussed above is a significant factor which cannot be controlled for. This problem is likely to be exacerbated in sites with only very small excavations, such as Spring Cave where only 2m² have been removed. Of course these sorts of differences may also be apparent between sites located in different physical environments, which may also, as in the case of Elands Bay Cave, change with time.

In addition, artefacts are quite likely to have migrated to various degrees within the deposits causing a mixing of material across layers. This mixing is likely to start during actual occupation of the sites, since the people, living there would be scuffing the deposits, digging pits and bedding hollows, and occasionally burying someone (Matthews 1965). Each of

these actions are likely to introduce older material to the surface layers, causing mixing of the deposits. Villa and Courtin (1983; Villa 1982) cite several examples of sites where conjoinable artefacts (lithics and pottery) have been recovered over some depth, despite close horizontal proximity, in both cave and open sites. This suggests considerable movement of artefacts through the deposits, and as a result, the authors caution against the over-reliance on microstratigraphic units in the interpretation of sequences. These are small items and might be expected to move more than larger ones. Sealy and Yates (1996) have highlighted similar problems with the migration of sheep bones in South African deposits. General trends in stratified sites should therefore be examined fairly loosely when describing change.

Another major consideration is that shell middens unfortunately tend to be associated with somewhat scruffy and informal lithic assemblages, frequently lacking in artefacts characteristic of particular periods. Some of the Elands Bay sites, including Elands Bay Cave, follow this pattern to a greater or lesser degree resulting in the existence of a great deal of variability among these sites. As such, the current sample of sites does not contain an ideal standard LSA assemblage to which others might be compared. With many of the other more recent sites in the area being shell middens though, a direct comparison of midden sites is still feasible.

An assemblage from a site located a little way off the coastline would have been a useful inclusion in this research, as it would have provided a good idea of what a more typical Holocene lithic sequence in the area should look like. The data provided by Robey (1984, 1987) and Jerardino (1996) indicate that Tortoise Cave, a rockshelter located just over 3 km from the coast on the mountain slopes above the south bank of Verlorenvlei, (Figure 2.1), quite likely does contain such a sequence. Unfortunately, several problems associated with

this site preclude its inclusion in the current research, the most important being that a substantial portion of the lithic assemblage is missing and no longer available for reanalysis. Furthermore, numerous problems with regard to the interpretation of the dates and layers exist (Jerardino 1995), thus rendering this material unreliable.

The site of Scorpion Shelter (Wahl 1994), located in the mountains some 8 km south of Verlorenvlei, was also considered to contain a non-midden type assemblage. Unfortunately most of the lithics from the small excavation at this site are also missing and hence unavailable for study.

Ideally, excavation of a deep LSA sequence away from the coast would help overcome this problem and would provide a useful sequence with which coastal midden sites could be compared. Unfortunately no such sequence is as yet known in the vicinity. Although located some 18 km north of Verlorenvlei, Steenbokfontein Cave (Jerardino & Yates 1996; Jerardino & Swanepoel 1999) may well prove to partially fulfil this role in the future.

3.2 ARTEFACT CLASSIFICATION

3.2.1 Discreteness and its implications for assemblage interpretation

For a lithic classification to be successful, its categories have to be created in such a way as to make each a unique, discrete entity. A lack of discreteness among classificatory terms can cause significant problems in the interpretation of analyses and the comparison of different classifications. It is quite clear that different workers perceive archaeological lithic assemblages in very different ways. This is not always a result of their perception of lithic classes, but certainly this factor can cause problems when workers are interpreting definitions

differently. Some of the issues concerning discreteness are now discussed. Before turning to artefact categories, a brief mention of the broader terms used in describing the LSA Industries referred to in section 2.1 will be made.

While the terms 'Robberg', 'Oakhurst' and 'Wilton' are the most frequently recognised terms used in describing the LSA of southern Africa, I prefer not to give too much weight to these categories at the interpretive level. Although they provide a useful generalisation concerning the assemblages being dealt with, there are always those that will not fall cleanly into one or another of the categories. Due to such inconsistencies occurring, I prefer to merely describe assemblages by their primary attributes and associated dates rather than trying to confine them to specific industrial categories.

Turning now to artefact classification we find that at various times in the past different people have compiled their own sets of criteria for the classification of stone artefacts (e.g. Sampson & Sampson 1967; H. Deacon 1976; J. Deacon 1984b). In addition to this, a number of others have devised their own variations on existing schemes, with that of J. Deacon being the most often modified, and indeed since 1984, mainly for the purposes of comparability, it is on her system that most others have been to a greater or lesser degree loosely based. This range of schemes, and the fact that most authors choose to list their own set of class definitions, has led to a lack of clarity, and hence discreteness, in many categories. This has long been recognised as a problem (e.g. Inskip 1967), since a single set of clearly defined artefact types covering the entire southern African LSA does not exist. Janette Deacon's (1984b) effort at compiling such a list for the southern Cape goes a long way towards solving the problem, but since it is limited geographically and is slightly outdated, it is still not comprehensive for the subcontinent as a whole. It is important to compile such a list for the

entire subcontinent in order that each artefact class might be recognised as a discrete entity thus aiding the comparison of different industries in different areas.

It has been stressed by Binford and Binford (1969) that, in the style of *la méthode Bordes*, widely used for the European Middle Palaeolithic, stone artefacts should be classified according to explicit morphological attributes and manufacturing techniques without putting any weight on the greater cultural significance of any particular tool type. These defining characteristics are determined by a variety of factors such as raw materials, function and major stylistic influences such as those encountered between different industries. This approach would encourage the clear distinction of artefact classes from one another since undue attention to minor stylistic details or probable functions, especially given the difficulty in determining the latter, would very likely lead to a loss of discreteness. Tools presumably performing similar functions were certainly made differently through time and space (e.g. scrapers) such that any attempt to group these implements solely by their presumed function could result in extremely broad classes. Ultimately what is required to ensure discreteness is a set of definitions clearly stating the criteria needing to be fulfilled for each class with any variable factors stated as such or omitted from the class as defined.

The problem of the proliferation of terms has already been recognised (e.g. Parkington 1986b; Thacker 1996). In a study of the Upper Palaeolithic in Portugal, Thacker (1996) identified 105 different tool types based on relatively minor factors such as the side of the flake which was retouched. With so many categories, a loss of mutual exclusivity would result in a meaningless distribution across classes. Hence it was found to be necessary to condense these into 24 classes using more meaningful definitions based on gross edge shape. One also needs to consider whether the identified classes are not perhaps “arbitrarily defined

segments along a line of continuous variation” (Dibble & Rolland 1992:6). While discreteness is at a premium, one must be aware of not creating too many classes by identifying variation within as opposed to between classes. By way of illustration, White and Thomas (1972:304), working among indigenous people in New Guinea, have determined through experimentation that among the manufacturers of stone artefacts “each individual’s classifications vary both in their short-term stability and in the features in which variability is allowed to occur”. In other words, when they asked people to make a particular artefact type, the results were quite variable, despite the fact that all the knappers referred to the tools by the same name.

Besides stylistic and manufacturing variation, two further sources of variation exist – the breakage and discarding of tools. Broken tools may be repaired by the addition of fresh retouch or even reworked into entirely new forms. Both processes may result in intermediate tool forms displaying variation significant enough to prompt classification into the miscellaneous class. The problem of tool discard is perhaps less straightforward. Although it is quite likely that stone tools were purposefully thrown away (Rolland & Dibble 1990), perhaps when they were due for replacement (H.J. Deacon 1976; H.J. Deacon & J. Deacon 1980), it is equally likely that many, especially the small LSA ones, were lost. Discarded tools may have been ‘used up’ in the eyes of their makers resulting in the presence of further variation within classes based on the degree of use of tools. For us, the analysts, knowing which are used up and discarded tools and which lost is virtually impossible in most cases. Although neither point is likely to be a significant problem, they should be borne in mind as sources of variation during the interpretation of lithic assemblages.

A final consideration relates to the correct identification of artefacts – in terms of both their physical identification and the names of the categories or classes into which they are placed. If not correctly identified then certain classes or categories would be over- and others under-represented by the data. This is of particular importance with regard to the edge-damaged category which will be discussed in greater detail below.

3.2.2 The classification system and class definitions

Since this research deals only with flaked stone assemblages, only the flaked stone categories are presented below and the descriptions given are those employed in this work. Many are based on the criteria set out by J. Deacon (1984b) but various additions and changes have been incorporated. All artefacts are divided into ‘cores’, ‘débitage’, ‘edge-damaged’ and ‘formal tools’ as shown in Figure 3.1. Only descriptive information is given here and a discussion on artefact classification and terminology follows in Section 3.2.3.

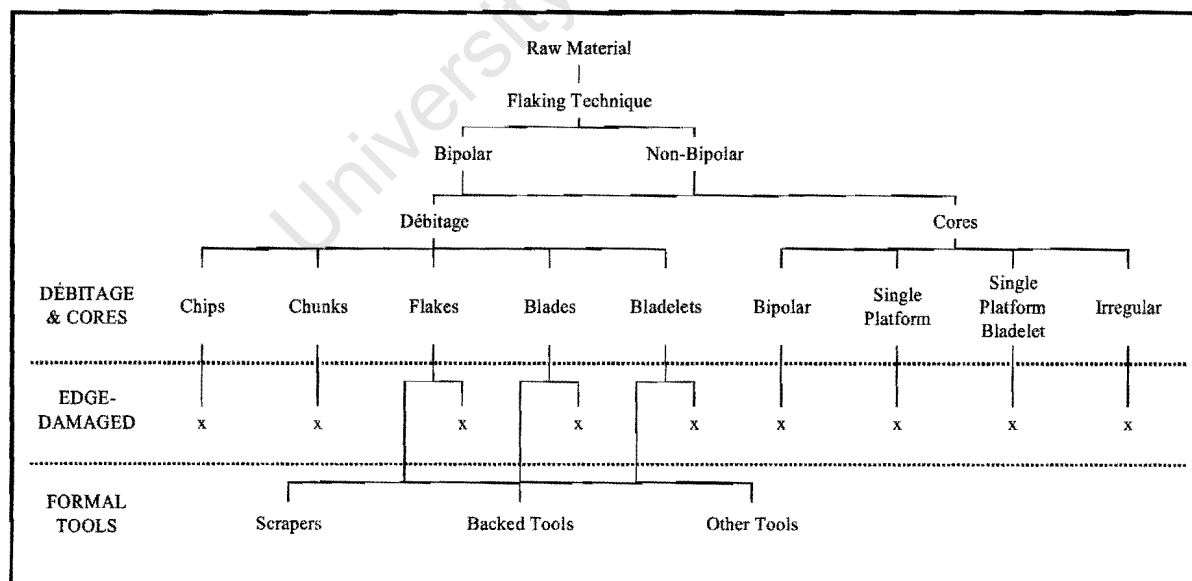


Figure 3.1 Lithic reduction sequence adapted from Barham (1989b, Fig. 23).

Cores

Cores are pieces of raw material from which flakes have been systematically removed in a particular manner. They are usually, but not always, identified by the presence of at least three flake scars.

Bipolar Core: an extremely variable core, often roughly pillow-shaped, with two opposing platforms resulting from having been struck while resting on an anvil. The upper platform usually forms parallel to the anvil and is curved in plan view, while the lower one is straight and at an angle to the anvil. Flake removals occur on both sides of the core and individual scars are frequently difficult to distinguish. The three removal rule therefore cannot be applied to bipolar cores. Much variety in overall shape exists, and while two detachment faces are the norm, a longitudinal ridge occasionally develops down one side such that three faces are evident. The platforms occasionally develop at 90° to one another in the horizontal plane and on rare occasions only one platform develops with the other end merely becoming badly bruised. The platforms usually resemble a chisel-like edge, but can also be somewhat pointed or even flat. Occasionally, and most often during the late Pleistocene, these cores were so reduced that only a tiny, slender core with a pointed platform on either end remains. These were the cores termed 'rice-grain cores' by Davis (1980). The ends of bipolar cores frequently appear slightly 'crushed' with this crushing generally taking the form of miniature (less than 1.5 mm long) flake scars that are often hinged.

Single Platform Core: this core shows at least three unidirectional flake removals from a single platform. Occasionally one finds two opposing platforms, usually on

opposite ends of a pebble, which independently function as single platform cores. This latter type is recorded as one core.

Single Platform Bladelet Core: a core with at least three flake scars, some of bladelet proportions, demonstrating removal from a single platform such that as more flakes are removed, the working face of the core tends towards a cone shape with the broad end being the platform. Often the flaking does not proceed all the way round the core.

Irregular Core: an irregular shaped, and frequently blocky core exhibiting at least three flake removals from two or more platforms.

Débitage

These artefacts are all those pieces other than cores with no visible edge damage. They are the primary products, whether intentional or otherwise, of any of a number of flaking procedures.

Flake: a piece with a maximum dimension ≥ 10 mm that shows a bulb of percussion and/or discernible striking platform and/or recognisable dorsal and ventral surfaces (Carter *et al.* 1988). Fragments are included if they fit the size criterion.

Bladelet: a flake with length : breadth ratio ≥ 2 and length < 25 mm. It must also have roughly parallel sides.

Blade: as for bladelet but with length ≥ 25 mm.

Chunk: a piece with no visible edge-damage and a maximum dimension of ≥ 10 mm that conforms to none of the preceding débitage and core classes.

Chip: a piece conforming to any of the above débitage classes but with maximum dimension < 10 mm.

Edge-damaged

Any non-retouched piece with minute, usually sporadic flake scars along an edge. This edge is either sharp or similar in angle to a scraper. Occasionally one or more small notches are present along the edge, probably as a result of the chance intersection of these tiny scars.

Formal Tools

This term refers to those artefacts which have been deliberately modified by the addition of secondary retouch which shapes the tool and/or gives a particular form to the working edge.

When defining these artefacts consideration is given to three characteristics of the tools:

- (i) The shape of the flake in plan view and the position of the retouch on the flake;
- (ii) the shape of the retouched edge in plan view; and
- (iii) the edge angle (internal angle of the cross-section through the retouched edge).

Formal tools are divided into three categories based on the type of retouch which dominates the piece. 'Scrapers' have a working edge sharpened by retouch to produce an edge-angle of approximately 40° to 70°, while 'backed tools' have an edge blunted, either uni- or bifacially to between 80° and 100°. 'Other tools' contains all those retouched types which have neither scraper nor backed edges and includes the miscellaneous retouched pieces.

Scrapers

Thumbnail Scraper: a small scraper similar in shape and size to a thumbnail. These grade into endscrapers and big-D scrapers but few intermediate size examples are found thus prompting the distinction of separate classes.

Endscraper: a scraper with retouch on one end of the long axis of a flake.

Big-D Scraper: a usually larger scraper made on a D-shaped flake. The butt, which forms the straight side, is usually the widest and highest part of the scraper and opposes the retouch.

Double Endscraper: a scraper with retouch on both ends of the long axis of a flake.

Sidescraper: a scraper with retouch extending down one side of the long axis of a flake (this does not include 'boat-shaped scrapers', which are pointed at both ends and of which none are present in the sample).

Double Sidescraper: a scraper retouched along both sides of the long axis of a flake.

Side-End Scraper: a scraper retouched on one end and one side of the long axis of a flake

Backed Scraper: a roughly boat-shaped (i.e. pointed at both ends) scraper made on a high flake and with backing opposing the scraper retouch.

Miscellaneous Backed Scraper: any scraper with a backed edge that does not conform to the 'backed scraper' class above.

Circular Scraper: a scraper of variable size on which the retouch extends around all or almost all of the perimeter of the flake creating a neatly circular shape in plan view.

Miscellaneous Scraper: a generic term for a scraper that does not conform to any of the other scraper classes.

Adiagnostic Scraper: a broken scraper which can no longer be identified because there is too little remaining to determine its original shape. It may also be a scraper edge deliberately broken or struck off a scraper (Yates, pers. comm.).

Backed Tools

Backed Flake: a flake with backing along one margin, usually opposing a sharp edge.

Backed Bladelet: a bladelet < 25 mm in length with backing down one side of the long axis which usually opposes a sharp edge.

Backed Blade: as for 'backed bladelet', but the piece is \geq 25 mm in length.

Backed Point: as for 'backed bladelet', but the two long margins meet to form a sharp point.

Backed Bladelet Fragment: a fragment certain to have been of blade or bladelet proportions prior to breakage and which is too incomplete to allocate to either of the above three classes.

Segment: a segment-shaped tool on which the curved edge is formed by backing and opposes a sharp, straight chord.

Borer: a small tool with backing on both lateral edges which cause the tool to taper towards the tip. There is sometimes polish evident on the tip due to use.

Drill: a tool with backing on both lateral edges, but with these edges running parallel to each other. Just before the tip of the tool both sides taper rapidly to form a point on which polish is sometimes evident as a result of use.

Miscellaneous Backed Piece (MBP): a backed artefact that does not conform to any of the above backed classes.

Adiagnostic Backed Piece: a tool that is too broken to classify but that displays clear backing.

Other Tools

Unifacial Point: a tool made on a convergent flake with scraper-like unifacial retouch on both lateral margins such that they meet in a point (Thackeray 1981).

Adze: a roughly rectangular to sub-rectangular piece with step-flaked retouch in the centre of one or both sides of the long axis of the flake.

Naturally Backed Knife (NBK): a large sidestruck flake on which the platform provides a naturally backed edge opposing a gently convex, scraper-like retouched edge.

Small Chopper: a larger tool of maximum dimension < 100 mm with a semi-sharp edge created by uni- or bifacial flaking and usually slightly blunted by use.

Large Chopper: as for 'small chopper' but with maximum dimension ≥ 100 mm.

Miscellaneous Retouched Piece (MRP): any irregularly shaped piece with retouch that does not conform to any other formal tool class.

3.2.3 Discussion of analytical terminology

Having presented the artefact definitions as used in this dissertation, I now turn to a general discussion on artefact classification and the creation of the typology. Included in this are sections providing further detailed explanations on specific classes outlining sources of variation as well as showing why certain choices were made in the compilation of the typology. Some of the problems encountered during the formulation and use of the scheme are expressed and explanations for the changes effected are offered. Factors that should play a role in the interpretation of assemblages are also considered from time to time.

Most typologies are based on a variety of artefact attributes with class definitions commonly arising from a combination of stylistic, functional, morphological, and technological attributes as appropriate (Barham 1989b). Admittedly it is difficult, and perhaps, some might argue, impossible to distinguish the contribution of each attribute to an artefact's overall appearance. A useful way of looking at formal tool classifications is presented by Steward

(1954) who recognises a number of different conceptions of type, of which his 'functional type', 'morphological type' and 'historical-index type' are considered here.

The 'functional type' provides the first tier of classification and refers to the internal angle of the retouched edge, with different angles suggesting probable differences in function. Through an ethnographic study carried out in Australia, Gould *et al.* (1971) determined that the makers of stone tools differentiated between knives and adzes purely on the basis of the profile of their working edges. Such distinctions thus also allow us, the analysts, to distinguish between those tools with scraper-like, backed or other retouched edges.

A consideration of 'morphological type' allows the artefacts in each of these three broad tool categories to be separated into distinct formal tool types based on their physical appearance. Consideration is given to the overall shape or plan view of the artefact and the placement of the retouch on the flake. Occasionally, when the tool category is unclear at the functional level, perhaps due to resharpening, its morphology will reveal to which functional type it belongs.

Further distinctions are occasionally drawn on the basis of the 'historical-index type' which considers those artefacts which are particularly prominent at specific times only. They can be only slightly different to other types, perhaps by virtue of size or style, although some can be quite unique. The usefulness of such types is twofold: either they can be used to indicate industrial change at the time of their inception or disappearance, or they can show periods of industrial stability when they are present over long periods of time.

Debate exists as to whether the archaeological classification of stone artefacts should reflect the way in which their makers thought of them (White & Thomas 1972). Since ethnography pertains only to the most recent people, we have no way of knowing what earlier artefact makers may have thought, so little point exists in attempting such a comparison. As White and Thomas (1972) point out, “the test of an archaeologist’s taxonomy lies in its suitability for solving his ‘puzzles’ rather than its possible similarities to a prehistoric folk classification”. In the current research, my ‘puzzle’ is to be able to reliably separate different artefacts into distinct classes based on the types set out above. The current scheme, as laid out in the previous section, appears to be suitable for that purpose.

Lithic classification schemes traditionally included three main categories, each recognised by a variety of names, although recently the first two below have been separated. The terms chosen here are ‘cores’, ‘débitage’, ‘edge-damaged’ and ‘formal tools’. These will now be discussed along with various classes falling under each. Note that some regard the term ‘artefact’ to denote only retouched or secondarily modified pieces, but here it is used in the more common generic sense to describe any piece of stone that has undergone primary flaking.

Cores

Bipolar cores

Bipolar cores have to some degree been a victim of the lack of wider reading by workers in southern Africa. With the technique having been documented, albeit somewhat incorrectly, by Van Riet Lowe (1946), it was given little further attention until the late 1980’s. Aside from this early use, and a passing mention that these artefacts might be cores (J. Deacon

1972; Schweitzer & Wilson 1982), the term ‘bipolar core’ is relatively new to South African archaeology having only been used here since the mid 1980’s. Prior to this time bipolar cores were recognised as retouched tools (e.g. Van Riet Lowe 1946; J. Deacon 1972), débitage (e.g. H. Deacon 1976), utilised artefacts (e.g. Thackeray 1981; Humphreys & Thackeray 1983; J. Deacon 1984b; Manhire 1984) and core by-products (e.g. Manhire 1987). At different times names such as *ouils* (Humphreys 1979), *ouils écaillés* (scaled tools), *pièces esquillées* (scaled pieces) and core-reduced pieces (Deacon 1984b) were all used. Workers in America and Australia, however, began recognising them as cores far earlier.

In America early use of the term ‘bipolar core’ was made by Binford and Quimby (1963) and McPherron (1967), while in Australia they were first recognised as cores, but termed ‘scalar cores’, by White (1968). Soon afterwards, however, the terms ‘bipolar artefacts’ (Vanderwal 1977) and ‘bipolar cores’ (Dickson 1977) were used.

The range of terms used in the past in southern Africa seems to reflect the many morphological differences between the common end-products of the process of bipolar flaking. Binford and Quimby (1963) found six fairly standardised variations, while Barham (1987:49), on the basis of replication experiments, concluded that *pièces esquillées*, *ouils écaillés* and core reduced pieces all “appear(ed) to represent variability in the form of exhausted bipolar cores rather than individual artefact types”.

Variability extends across both the shape and size of the cores. While the classic pillow-shaped bipolar cores are the easiest to recognise, they can also be fatter, thinner or flatter. Binford and Quimby (1963), in their excellent analysis of bipolar cores, noted that three types

of platform could combine to form six variations in the shape of bipolar cores. For further detail, their section on bipolar cores is contained in Appendix 2.

The smallest, thinnest bipolar cores, called 'rice grain cores' by Davis (1980), resemble a large grain of rice and only close examination will reveal their bipolar characteristics. Some workers employ the terms 'bipolar bladelet core' (Parkington & Yates, in prep. a), 'flat bladelet core' (J. Deacon 1984b, Carter *et al.* 1988) and 'small bladelet core' (Carter *et al.* 1988) as bipolar types. I regard these as being variations in form on the typical bipolar core and am in serious doubt as to the predictability with which bladelets can be intentionally struck from bipolar cores.

Due to the small size of bipolar cores, any bladelet scars present are always very small and narrow, frequently being less than about 3 mm by 12 mm. Cores displaying these scars have been termed 'micro-blade cores' by Schweitzer & Wilson (1982). The resulting bladelets would be far too small to serve any purpose. Furthermore, I have found through experimentation that the shock from their having been struck sometimes results in these tiny bladelets breaking up into 2 or 3 short sections such that bladelets of this size were probably seldom obtained from bipolar cores.

It might be that many workers employing the various terms mentioned above may consider, either consciously or not, that bladelets may have been produced when the cores were still larger. Following this line of reasoning, bladelets could have been struck from any bipolar cores, whether they exhibit tiny bladelet scars or not, and therefore, without direct evidence, I consider it unfeasible to create bipolar bladelet core classes. I believe that bladelets are far more likely to have been removed from bipolar cores by chance and that intentional

controlled bladelet production from bipolar cores is extremely unlikely. As a result of this lack of clarity, I have subsumed all bipolar classes created by other workers under 'bipolar cores'.

The secondary crushing on the platforms, identified in the past as utilisation damage, is almost certainly a result of decreasing core size. As the core gets smaller, effectively disappearing between the fingers of the knapper, it becomes more difficult to flake such that only a crushing of the edge results. The small size in which these cores are always found is an indication of the intensity of their reduction since the bipolar technique allows cores to be worked to their maximum potential.

A significant complication arises from the suggestion that wedges used for splitting wood or bone take the same form as the classic bipolar core (Ranere 1975). Most researchers have downplayed this suggestion in recent years, although Ranere (1975) and Binneman (1982), the latter through the application of microwear studies, have shown that it may be quite plausible. Sampson (pers. comm.), however, remains quite certain of their existence in southern Africa, while Mitchell (1988a:150), after a survey of the evidence states of bipolar cores that "while some of them may have been used as wood- or bone-splitting wedges, they are unlikely to have been produced with this objective in mind". Due to the lack of any obvious way of distinguishing wedges and bipolar cores I have elected here to identify all such pieces as bipolar cores.

One final and perhaps quite pertinent point relating to the sometimes extreme dominance of bipolar cores needs discussion. The bipolar technique allows the greatest possible reduction of a nodule of raw material to take place. As a result it may be that when another core type

has been worked out and is too small to be further flaked, it might be struck in a bipolar manner in order to maximise the possibility of gaining one or two more usable flakes from the nodule. This scenario would lead to extreme proportions of bipolar cores in the presence of few other core types. This is more likely to occur when raw material was scarce and extreme economy was necessary. The availability of only small nodules of raw material would serve to further encourage the use of the bipolar technique. Strategies of conservation of raw material involving use of the bipolar technique are elaborated in later chapters.

Single platform bladelet cores

While it is almost impossible to prove that bladelets were produced from any core, the naming of this class is in recognition of the fact that these cores show the most regular pattern of bladelet scars and are perhaps the most likely to have repeatedly produced bladelets. Wadley (1993) notes that single platform, conical bladelet cores often show evidence of bipolar striking although they do not have the chisel-like platforms so characteristic of bipolar cores. It seems quite likely, especially given the small size of both these and the following class of cores, that they were usually worked on an anvil, but in a far more careful and controlled way than normal bipolar cores.

Single platform cores

Reasonably large single platform cores are easy enough to understand, but frequently very tiny cores show all the characteristics of a single platform core. Dickson (1977), using good quality quartz, found that a lower weight limit of approximately 60g applied to cores worked in the hand. The Dunefield Midden 1 single platform cores, ranging in size between 0.9 g and 22.8 g, showed no evidence of bipolar working but all are very small making it unlikely that they were flaked by non-bipolar means (Orton 1998). It is assumed, therefore, that they

must have been worked on an anvil, being carefully and deliberately struck in such a way that a single, flat striking platform is created on the top of the core. Kaplan (1990) found the mean lengths of Robberg single platform cores at Umhlatuzana Rock Shelter to be between 12.3 mm and 14.6 mm. This shows that the very small single platform cores found at Dunefield Midden 1 (Orton 2002) are not extraordinary and that a similar technology to that at Umhlatuzana must have been employed in their creation.

Débitage

Although 'waste' is the most frequently used term for this category, some workers express concerns over the use of this term and prefer to use 'unmodified' (Carter et al. 1988, Mitchell 1988a), unretouched (Barham 1989b) or non-retouched (Thackeray 1981). The term 'waste' can be taken to imply that no subsequent use of the artefacts was made (Barham 1989b; Carter *et al.* 1988) and, since both microwear analyses (e.g. Binneman 1984) and residue analyses (e.g. Schafer & Holloway 1979; Williamson 1997) demonstrate their use, the term has been dropped. It has been suggested that 'débitage' is the most neutral term and that it eliminates the argument over whether artefacts so classified really are waste (Sampson, pers. comm.). Further discussion on this latter point follows under 'edge-damaged' below.

Although conventionally referring to a process by which raw material is reduced and flakes produced (Inizan *et al.* 1999), *débitage* may be seen as "the tangible results (*débitage* products) of this action" (Inizan *et al.* 1999:138; their brackets) or "the by-product of stone tool production or core reduction" (Andrefsky 1998:17) and includes all detached pieces or flakes that have not been used as tools in their unmodified state or made into tools.

Flakes

A problem peculiar to quartz is the difficulty of identifying flakes due to the irregular fracturing that occurs with this material. Thackeray (1981:58) makes a useful observation in recognising flakes as “artefacts removed from cores by percussion”, while Andrefsky (1998:81) includes artefacts that show “a single recognisable dorsal and single recognisable ventral surface”. These definitions include all broken flake fragments and in order to be inclusive I have kept the flake definition as broad as possible.

Bipolar flakes can sometimes be difficult to distinguish from bipolar cores with the flakes occasionally having tiny flake scars on both sides of both ends. In such instances, the bulb may be the only flake characteristic evident.

The classification of possible ESA or MSA flakes collected from other sites presents an interesting problem. Technically they are manuports if they have not been worked any further. Unless these flakes are clearly more weathered than other flakes in the assemblage there is no guarantee that they were not struck by LSA people, either on the site or elsewhere. However, with so few such flakes existing in the current set of assemblages, it is felt that their impact on the analyses is negligible. The most important consideration here is that it shows that LSA people were aware of other sites and were prepared to scavenge from them.

Blades and bladelets

Although we define a blade as a flake with a length greater than twice its width, to what degree is a twisted, skew and wafer thin flake functionally useful as a blade? Many add the qualifier that blades must have parallel sides (e.g. Mitchell 1988a; Schweitzer & Wilson 1982), which adds some sense of the notion of usefulness as perceived by the stoneworker.

In other words, blades must be of a regular, repeated shape and those flakes that do not conform but still maintain the correct proportions due to chance are excluded from the class. Following Schweitzer & Wilson (1982), pieces that do not quite maintain the width : length ratio of ≥ 2 but are clearly broken blades or bladelets are still included.

Barham (1987) adds an extra division to the blade class as defined above, recognising 'functional blades' as those with a thickness ≤ 6 mm and a cutting edge angle ranging between 30° and 60° . This distinction is based on the measurement of backed bladelets and segments from Siphiso Shelter, Swaziland, and assumes that those unretouched bladelets not conforming to these specifications would have been seen as 'non-functional' by the stoneworkers. No attempt at such a distinction is made here.

Schweitzer and Wilson (1982) also include a sub-class of 'micro-blades', which they describe as blades shorter than 15 mm. Although some small bladelets may have been used (e.g. Binneman & Mitchell 1997), most bladelets of less than 15 mm are unlikely to have been able to serve a purpose. As such, they are not considered worthy of being recognised as a separate class in this analysis, with only the 25 mm distinction being made.

Chunks

Within my chunk class are artefacts displaying two flake removals and recognised as 'minimal cores' by Yates and Jerardino (Jerardino 1996). It is likely that these pieces are fragments of cores broken off during flaking. They are unlikely to provide us with any extra information and are not considered further here.

Edge-damaged

This is the category known to most workers as 'utilised', but owing to the uncertainty over the causes of the damage being identified on the pieces so classified, I have elected to use the more generic term 'edge-damaged'. It should be noted that 'edge-damaged' is something of a wastepaper basket category since it covers a variety of possible scenarios for the formation of the damage that is included here. Occasionally one finds artefacts with damage which is clearly neither retouch nor utilisation, and these are also accommodated here. Of course utilisation is probably still the most frequent means by which edge-damage is produced. At DFM 1 the strong spatial correlation between edge-damaged (there termed 'utilised') and retouched pieces (Orton 2002) does suggest that most of the former were the result of use rather than accidental production. Various other possibilities, however, do exist.

The most common is likely to be trampling, especially in the relatively confined spaces of rockshelters and caves. Experiments have shown that significant amounts of damage can occur through trampling (Keeley 1980; McBrearty *et al.* 1998) ranging from very light, sporadic peripheral damage to items which were even classifiable under the Bordes (1961) typology. Edge-damage can also occur during artefact production (Sheets 1973), during natural post-depositional soil movements (Levi Sala 1986) and even during excavation, analysis and storage (Gero 1978 and Muto 1979 in Young & Bamforth 1990). Very light retouch could even appear to be utilisation. It is usually not possible to tell apart the different means of production of edge-damage (Young & Bamforth 1990), although an experienced worker should be able to distinguish utilisation from other forms of damage under magnifications of at least 50X - 80X (Odell, pers. comm.). However, such magnifications are seldom used during lithic analyses, thus lending support to the use of the term 'edge-damaged' for this category.

Under utilised artefacts, J. Deacon (1984b) and Carter *et al.* (1988) recognised ‘notched pieces’ as having notches of at least 1 mm diameter and comment that they result from the intersection of two flake scars. This distinction is of fairly limited value since it is clear that no functional difference exists between these and other utilised pieces, and we know that deliberately retouched notches do exist in the LSA as well (e.g. Schrire 1962; Rudner & Grattan-Bellew 1964; Orton & Halkett 2001).

It is also fairly certain that not all utilisation will leave damage which is detectable, although wear resulting from use can be quite well developed (Binneman 1984). Since it is highly impractical to conduct use-wear studies on all artefacts, many utilised pieces probably go unnoticed into our débitage classes.

Formal Tools

No strong objections to the use of the term ‘formal tools’ exist although some prefer terms such as ‘retouched’ (Barham 1989b) or ‘formally retouched’ (Carter *et al.* 1988; Mitchell 1988a). The identification of retouch is normally quite straightforward, although occasionally pieces occur on which the retouch is only marginal and could even be the result of heavy utilisation. On such pieces one simply has to make a judgement call based on the appearance, placement and characteristics of the individual scars.

It is important to remember that while functions are suggested by tool names, these are not necessarily implicit, since the tools may have been used differently in the past. In Australia, ethnographic work has shown that artefacts, known as *yilugwa*, which might otherwise have been classified as scrapers (Gould 1980), actually serve as scrapers and spoons, with some possibly being used as knives as well (O’Connell 1974).

Little further discussion on formal tools is needed over and above the definitions, although a few classes will benefit from some further comments.

Thumbnail, Big-D and Endscrapers

These three types are essentially variations of endscrapers based on flakes of different shapes. Thumbnail and big-D scrapers grade into each other by way of size but are distinguished by their platforms. The thumbnail usually has a butt that is slightly narrower than the widest part of the scraper, while the butt of the big-D scraper is always its widest part. Very seldom does one find a big-D scraper small enough to consider in the thumbnail class.

Thumbnail scrapers grade into endscrapers based on length. However, with thumbnail scrapers almost always being almost exactly the size of the average thumbnail and with very few larger examples being found, the distinction is usually easy. The occasional larger one is kept in the class if its shape is of the correct proportions while those that become slightly longer are placed in the endscraper class.

Side-end Scrapers

These are somewhat variable in shape ranging from blade-like to fairly square. The distinguishing characteristic is the presence of two sections of retouch that are usually contiguous, and located at 90 degrees to each other on neighbouring sides of a flake.

Circular Scrapers

Carter *et al.* (1988) have suggested that circular scrapers should be retouched around the entire circumference of the piece. The perfectly round nature of these scrapers makes them so distinct that it is beyond doubt that those pieces with a slight 'flat spot' at the platform are

morphologically very much closer to this class than any other class. As such I have amended their definition accordingly for the current work.

Backed Blades, Bladelets, Points and Backed Bladelet Fragments

A large suite of classification terminology based on the reduction sequence devised for the European Middle Palaeolithic (Movius *et al.* 1968) exists for these classes (Close & Sampson 1998; H. Deacon 1976), but is not included here due to the fact that the backed bladelets from Elands Bay are far less formalised. Researchers from the University of Cape Town have frequently distinguished backed bladelets and points on the basis of the presence of retouch on the base or butt of the piece (e.g. Manhire 1987). However, here I have reverted to the definitions as given by J. Deacon (1984b) since they are the ones more likely to be recognised by workers in other parts of South Africa.

On the application of H. Deacon's (1976) system, I am in agreement with Thackeray (1981) who points out the difficulty in telling apart Deacon's (1976) broken and truncated backed blades. A snapped tip would look the same if it was intentionally broken or if it broke during use. Proximal and distal discards can be readily identified only when the retouch does not extend to the very tip of the piece, but one would assume that if the retouch was carefully applied to the tip of the bladelet then it must have been intended for use with the point intact. However, with the informality of the Elands Bay backed bladelets, discards are unlikely to exist. All remaining snapped or broken fragments, if too short to otherwise classify, have been placed within my 'backed bladelet fragment' class so as to avoid unnecessary inflation of the other classes.

Borers and drills

The definitions and discussion pertaining to drills and borers are somewhat tentative due to the very few examples encountered during this and other research undertaken by myself over the last few years. In other western Cape research these artefacts are usually placed into a single class called either drills (e.g. Parkington 1980; Manhire 1987; Wahl 1994), borers (Parkington 1980; Mazel & Parkington 1981), or borer/drill (e.g. Jerardino 1996, 1998). Parkington (1980:75), through his use of both terms interchangeably, suggests that both terms are equivalent. Both terms have been used for more than three decades although 'borer' is undoubtedly of greater antiquity having been used by Van Riet Lowe (1926) in the early 20th century. It is important to note that, just three years later, Goodwin (Goodwin & Van Riet Lowe 1929) applied the term to both the tiny backed tools discussed here and the large artefacts which we call reamers today (J. Deacon 1984b), although he refers to the former as 'ostrich egg-shell borers' or 'bead borers' and the latter as 'stone borers'. Robey (1984, 1987) also recognised separate drill and borer classes, as I have done here, but unfortunately supplied no definitions. In her southern Cape classification system, Janette Deacon (1984b) recognises only one of these terms – the borer. Here I have provisionally chosen to place them into two classes based on the four specimens contained in the mid-Holocene assemblage from DFM 1. Recent excavations on the Northern Cape coast (Halkett 2003) have produced an assemblage with significant numbers of these tools and it is hoped that further research might help to either clarify or invalidate the distinction.

Here the distinction is made on the basis of a morphological difference which suggests that they may have been used in different ways, even if for the same function. Both are formed by the application of backing to a flake. Drills are parallel-sided with a sharply tapering tip, while borers tend to be tapered relatively consistently for at least half their length. It is

possible that this was merely a stylistic difference, although it could also reflect different techniques of utilisation of the tools.

Choppers

Although not really a problem in the study of Later Stone Age lithics, the manufacture of core tools could occasionally be problematic and it is important that these are recognised as tools rather than cores. Choppers, which are shaped by the rough flaking of a large piece of raw material, are the only such pieces in the current sample.

Adzes

These woodworking tools might not be classifiable as 'formal tools' depending on how the term is defined, since the 'retouch' present on them is quite possibly the product of sharpening rather than secondary retouching of the flake. This is difficult to tell, but use wear analyses on adzes from Boomplaas Cave have suggested that this may have been the case there (Binneman & J. Deacon 1986). Experimental manufacture and use of stone adzes has shown that the flake scars extending from the working edge onto the dorsal surface of the artefacts were applied by a stone hammer and are distinct from the much smaller scars on the ventral surface which were clearly the result of damage during use (Binneman & J. Deacon 1986). Sharpening is technically secondary retouch and it therefore seems reasonable to include these artefacts in the formally retouched tool category.

Miscellaneous Retouched Pieces

The MRP class is an interesting one. Its main purpose is to house those tools not conforming to any of the other categories and that the analyst simply cannot identify, possibly because they are unknown forms, but more likely because they are incomplete. Usually one defines

them as being tools that possess regular retouch that does not follow a common, recognisable pattern. A number of possibilities exist that would allow classification in this class.

Unfinished tools are quite likely to make up a significant proportion of MRPs. Any tool which either broke during manufacture or which was not turning out the way it was supposed to would be discarded immediately unless it could still be made into the same or another type of tool by the addition of further retouch. Ethnographic studies in Australia have confirmed the existence of this behaviour (Hayden 1977). MRPs may also exhibit different types of retouch, for example backing and scraper, on the same edge. This is likely to be the result of a manufacturing error or a flaw in the stone being shaped, although one cannot discount the likelihood of unknown tool classes existing. Others may have an identifiable retouch type and a working edge shape which do not match each other and hence do not match any existing formal tool definition.

A particular activity may require the use of a particular tool which is otherwise very seldom made. When such artefacts are found by archaeologists, they would not be classifiable under the existing set of types and in all likelihood would be placed under miscellaneous retouch. There is also the possibility of extremely specialised tools being made such that only one was made to perform a very specific function. While the tool would be complete, it would be of an unknown form. With only a single example being present, there would be no justification for a new tool class to be formed. By way of example, I have seen a roughly rectangular artefact with scraper-like retouch along one of the ends. This end was very slightly concave and clearly the piece was made to an intended form.

Edge-damage resulting from trampling can simulate retouch closely (McBrearty et al. 1998), as could heavy utilisation. Any pieces incorrectly identified as such would more likely be classified as miscellaneous retouch.

While comparison of the frequency of MRPs and other tool classes would not be meaningful, the proportion of MRPs does give an indication of the informality of the formal tool assemblages.

3.3 RAW MATERIAL CLASSIFICATION

3.3.1 Problems encountered by archaeological classification

Here some problematic aspects to raw material classification are outlined, while the definitions of the raw material categories cited in this research follow in Section 3.3.2. Most stone artefact raw material classifications are done without the consultation of a qualified geologist and I believe this can lead to a number of inaccuracies. The difficulties experienced are adequately illustrated by the degree of relabelling of raw materials each time an assemblage is reclassified. I occasionally changed raw material classifications, sometimes reverting back to a rock type that had already been assigned to the artefact by a previous researcher and then subsequently changed. In an analysis of Elands Bay Cave material, Pettigrew (1977) also recognised this problem, pointing out that consultation with geologists had revealed inaccuracies in her own classification. Robey (1984) makes a number of important points with regard to the archaeological identification of rocks in his discussion of raw materials at Tortoise Cave, some of which are touched on below.

Archaeologists tend to classify lithic raw materials on the basis of their physical appearance, while geologists use the microscopic physical structure and/or origin of the rocks to classify

them. Quite often a thin petrographic section of a rock sample is required in order to correctly tell what type of rock it is (Board, pers. comm.), the reason for this being that the individual pieces we encounter in lithic assemblages are frequently far too small to be diagnostic. Due to the destructive nature of this technique it is almost never employed by archaeologists.

A classic example of the problems arising in raw material classification is the distinction of microcrystalline quartzite, chert, shale and hornfels. Each of these rocks can appear similar in hand specimen and all can, and often do, occur in black. They can therefore frequently be difficult, if not even impossible, to tell apart. Nesse (2000) points out that chert and cryptocrystalline silica can appear the same in hand specimen and only their microscopic structure, when seen in thin section, can be used to tell them apart. Shale and hornfels grade into one another based upon the amount of heat the shale has been exposed to, making them difficult to tell apart. Quartzite and hornfels, as pointed out by Robey (1984), can tend to grade into one another visually, despite being unrelated rocks, and as such a distinction based only on a subjective visual examination is all that the archaeologist can hope to achieve. Further detail from a geological perspective can be obtained in Appendix 3.

For many years archaeologists in the Cape used the term 'indurated shale' to describe black fine-grained pieces, until someone suggested that these were actually hornfels, at which point a simple switch was effected (Parkington, pers. comm.). A distinction between hornfels and spotted hornfels was then also made, although spotted hornfels are merely those rocks which have not yet been metamorphosed enough to become true hornfels (Mason 1990). It is quite likely that many of the fine-grained black rocks present in Western Cape sites, and frequently displaying pebble cortex, are chert (Board, pers. comm.), a cryptocrystalline form

of silica (Whitten & Brooks 1972), rather than any other rock type. This became apparent and resulted in my introduction of the term 'fine-grained black rocks' to describe those raw materials which could not be confidently placed in one or other category. Interestingly, Wadley (1987) recognised a similar problem to that described here, and used the term 'black rock' as a raw material category to distinguish those visually similar black rocks that could not be accurately identified to type. To some degree H.J. Deacon (1976) also recognised and attempted to rectify this problem by creating a raw material classification called 'chert/silicified shale', while Carter *et al.* (1988) used the term 'lydianite' to refer to rock coming from very near to the dolerite intrusion and 'dyke material' for those less completely metamorphosed rocks coming from further away from the intrusion. Manhire (1987:63) refers to 'indurated shale' as all "those shales or mudstones altered by metamorphism" and recognises hornfels and lydianite as different forms. In this sense 'indurated' is meant to imply that the material has been heated, while in current geological parlance it is taken to refer to any process, including those involving pressure and cementation, by which soft sediment becomes hard rock (Whitten & Brooks 1972; Board, pers. comm.).

Quartzites and sandstones can also provide problems due to the tremendous variety of both quality and grain sizes present. Technically, many of the rocks that archaeologists call quartzite are actually sandstones with the degree of cementation of the latter usually introducing the confusion. Although Robey (1984) recognised this problem, he chose to maintain the classification used by most researchers. While the current quartzite category will still contain some higher grades of sandstone, I have attempted to remove the obvious sandstones from the quartzite category. The cementing of sandstone also leads to confusion between some of the higher grades of this material and silcrete, and as a result, some sandstone artefacts may have been called silcrete in the past. In addition, just to confuse

things further, silcrete can even form within sandstone (Board, pers. comm.; Smale 1973) and is itself a type of sandstone anyway (Roberts, pers. comm.).

The category commonly known as 'unidentified raw material' or 'other' is usually used for any rock type which cannot be identified by the archaeologist. The latter term is preferable as it allows those rock types which are identifiable but very scarce to be included, thus avoiding the accumulation of too many raw material categories. The use of this category could, however, obscure information on raw materials, since it might be the case that the rock is identifiable but scarce, either due to its having been obtained by exchange from another area, collected far away during long distance group movements, or collected as a pebble from river gravels which could have originated hundreds of kilometres away. Often there is some degree of weathering or patination which makes identification difficult and can serve to inflate the number of 'unidentifiable' pieces. It is for this reason that geologists like to see a fresh section when making identifications.

There is no way that archaeological raw material classifications can be seen as geologically definitive, rather, they should be seen as the archaeologist's best attempt to group similar types of rocks. There is no real solution to the problems of raw material classification and at best the archaeologist can only make educated guesses.

Another terminological problem relates to the use of the words 'local', 'non-local', 'imported' and 'exotic' in describing raw materials. What defines a raw material as being 'local'? While Perlès (1992) uses a five kilometre radius around sites to define locally derived materials, I prefer to see the answer to this as being variable from site to site, possibly depending on the social context of the inhabitants. A daily foraging round might vary in

extent from place to place and, as a result, 'local' might depend on the size of the home range. In addition, 'non-local' materials can be available 'locally' in river gravels, which would further serve to blur the dichotomy. Higgs and Vita-Finzi (1972), in establishing the area of a 'site territory', which they describe as "the area habitually exploited from a single site" (1972:30), have proposed two radii of 5 km and 10 km around the site for sedentary and mobile economies respectively. They do, however, note that this range is better defined by the time taken for a trip, and that broken or difficult terrain would cause distortion from an ideal circular territory. Lee (1969), examining the !Kung Bushmen in the Kalahari, noted that the distance from water rather than from the camp was ultimately the biggest factor in determining the cost of obtaining food. A roundtrip of more than about 25 km from water would require the provisioning of the party for an overnight trip. Higgs and Vita-Finzi (1972:30) also make use of the term 'site catchment' which they define as being "the terrain covered by occasional forays in search of raw materials for tools and other purposes". This is obviously far bigger than their 'site territory' and is likely to be the area which contains the sources of most raw materials. We may also choose to describe as exotic those materials which could only be acquired either by trade or by direct procurement from sources far away. Clearly resources in the 'site catchment' are no longer local, but at the same time neither are they exotic. Perhaps it is material from this area which we can refer to as imported? Either way it is important to establish clearly what is meant by these terms if they are to be used. In this work, I regard those materials commonly available in the immediate vicinity of Bobbejaansberg (i.e. more or less within the research area as shown in Figure 2.2) as local, while most others are assumed to fall within the site catchment since they are quite likely available within perhaps 10 to 15 km. Unfortunately the difficulties inherent in sourcing raw materials complicate this judgement, with the only material known not to occur in the area being hornfels. This latter can certainly be regarded as exotic since it is likely to have been

procured from the inland Karoo region. Mitchell (in press) cites several examples of *hxaro* items moving anything from fifty to a few hundred kilometres across the landscape, suggesting this to be quite possible.

3.3.2 General introduction to raw materials

Here a general archaeological and geological introduction to the raw material categories used in this research is provided. For a detailed geological account, please see Appendix 3.

Quartz: The mineral silica occurs in a number of forms, of which quartz is the most common. This material is ubiquitously available and widely used throughout the Later Stone Age. It is usually available as pebbles, either extracted from conglomerates or collected from river gravels. Vein or milky quartz (white) and crystal quartz (clear) are also available in the Table Mountain Sandstones with the former frequently offering larger, and sometimes poorer quality lumps of raw material. Crystal quartz results from slow, low pressure cooling of molten silica, while rapid, slightly pressurised cooling will produce the milky variety (Board, pers. comm.). Quartz pebbles and crystals are most frequently worked via the bipolar technique, although other methods are sometimes used on larger pebbles and blocks of vein quartz. Due to the crystalline nature of the stone, fracturing is frequently unpredictable, especially in pebbles and vein quartz, although with good quality material a conchoidal fracture is sometimes present. All artefact types are made on quartz, but formal tool frequencies are typically low.

Sandstone: Sandstone consists of skeletal sand grains cemented together. It tends to fracture around rather than through the grains, since the cement is generally weaker than the grains.

Sandstone is infrequently flaked, but silica-cemented sandstone, sometimes known as 'orthoquartzite', is the toughest and most commonly flaked variety. These rocks are widely available in the Table Mountain Series. Flaking usually proceeds by non-bipolar percussion from larger cores and only very occasionally will artefact types other than débitage and cores be found in sandstone. Larger artefacts, such as choppers, are usually made in this material.

Quartzite: When sandstone is metamorphosed, quartzite is formed. The degree of metamorphism increases with depth resulting in the occurrence of some intergrading between sandstone and quartzite. While sand grains are still present in sandstones, quartzites have essentially melted and recrystallised such that they are composed of a mosaic of interlocking crystals. Although usually fairly coarse-grained, quartzite sometimes occurs as a fine-grained rock well suited to flaking. Due to the larger size in which quartzite is available, one often finds larger artefacts manufactured from it. Of particular note here is the fact that Middle Stone Age artefacts, which are usually far larger than LSA ones, are most frequently made on quartzite, while LSA artefacts, often demanding finer working, are seldom in this material. Quartzite is widely available in the local Table Mountain Series and is more frequently flaked than sandstone. Non-bipolar flaking techniques are most frequently employed and occasional edge-damaged pieces and formal tools will be found on quartzite. In practice, 'quartzite' will always include some high quality sandstones that are hard to differentiate from quartzite.

Silcrete: This material is composed of quartz grains 'floating' in a silica matrix and is highly variable with both fine and coarse grain sizes being encountered. The variety of silcretes is a result of both the wide range of conditions under which it forms and the range of substrates in which it forms (Summerfield 1982). The classic easily recognised silcrete consists of a cryptocrystalline silica matrix with scattered quartz grains floating in it. It is the coarser,

conglomeratic silcretes, of which the Elands Bay outcrop is an example (Roberts, pers. comm.), which are harder to identify. Part of the difficulty in identification comes from the fact that silcrete is basically silicified sand (formed under conditions of fluctuating groundwater), and therefore in its own right, it is essentially a type of sandstone (Roberts, pers. comm.), but formed in a very particular way (Board, pers. comm.). Silcrete is known to occur along the Olifants River and on the coastal plain north of the current research area (Visser & Toerien 1971; De Beer *et al.* 2002). Those silcretes with a very fine-grained texture, usually called porcellanite, were formed in clays, while the slightly coarser ones formed in more sandy matrices. Silcrete horizons are usually between 1 and 3 m thick but can also be found thicker than 5 m (Summerfield 1983a). Most Cape coastal silcretes are associated with deep weathering profiles overlying shales, tillites and sandstones (Summerfield 1978 in Summerfield 1983a). While only one silcrete outcrop is known in the immediate Elands Bay area (Roberts, pers. comm.), pebble cortex present on some artefacts from Elands Bay Cave shows that this material was also available to prehistoric man in the form of river pebbles. Silcrete breaks with a sub-conchoidal fracture through both the matrix and the skeletal grains due to their being essentially composed of the same material. The finer silcretes are commonly flaked and formal tools are frequently preferentially made in this material. While the bipolar technique is sometimes employed for working silcrete, single platform cores are slightly more common. Bladelets and single platform bladelet cores are frequently made in this material, probably due to its relatively predictable fracture.

Cryptocrystalline Silica (CCS): Chalcedony and opal are cryptocrystalline and amorphous silica varieties respectively (Whitten & Brooks 1972). Since they are usually indistinguishable at the scale at which archaeologists examine them, both are included within CCS. Chalcedony actually includes some opal and water along with various impurities, with

the latter resulting in the range of colours in which the material occurs (Board, pers. comm.). Chalcedony includes the varieties known as agate (banded) and jasper (red). Chert, which is generally acknowledged to be slightly coarser-grained, is also included within the CCS category. These materials are most likely to have been obtained in pebble form, although chert layers have been noted in the Nama system and Malmesbury Formation rocks north of Lambert's Bay (Visser & Toerien 1971). Chert can occur in black, making it difficult to distinguish from other fine-grained black materials, especially microcrystalline quartzite, partly metamorphosed shales and hornfels, all of which can also occur in pebble form. The CCS found in archaeological contexts in South Africa is a chemical precipitate usually forming in cavities within carbonate and volcanic rocks and, as such, is most often available in nodular form. This fine-grained rock is well suited to stoneworking and flakes fairly predictably with a good conchoidal fracture. All means of flaking are employed and, as is the case with silcrete, this material is often selected for formal tool production. Despite being present throughout the Elands Bay lithic sequence, cryptocrystalline silicas are seldom used in the study area and few sources are likely to exist.

Fine-grained Black Rocks (FGB rocks): This term is a generic term devised specifically for and employed in this research to cover all those very fine-grained, dark-coloured rocks that are not readily identifiable without the aid of petrographic sections. They would normally be included within the 'other' category, but, due to their persistent, although somewhat minimal presence in the Elands Bay sequence, it was decided to formulate a unique category for these rocks. Very fine-grained quartzites with unresolvable crystals, dark shales in various states of metamorphism (including the final stage – hornfels) and possibly some cherts (e.g. lydite) will all fall into this category. Most artefact types are found made in FGB rocks, although adzes are by far the most common formal types to be made from them. Although classified

here as being made in FGB rocks, some naturally backed knives, artefacts normally associated with pre-8000 BP assemblages, have been shown through petrographic sections to be made in hornfels (Parkington, pers. comm.). Not all have been sectioned, but it is interesting to note this feature.

'Other': This term, also a generic, is widely used to include all those materials not readily identifiable in hand specimen or too infrequently used by prehistoric people to require inclusion in their own category. Often included here are igneous rocks, which are likely to have been sourced as river pebbles, although volcanic pipes have been located east of Lamberts Bay (Visser & Toerien 1971). An interesting, but rare inclusion, is the occasional flake of fossil bone. When patination of artefacts made in otherwise identifiable materials takes place, they can sometimes bear a surface so greatly changed as to render them unrecognisable. Such artefacts are usually classified as *'other'*. Due to the varied nature of raw materials contained within this category, all artefact types can be encountered, although formal tools are usually limited to miscellaneous pieces and larger types such as adzes.

4 THE SAMPLE

4.1 THE SELECTION OF SITES AND ASSEMBLAGES

The difficulty in obtaining an unbiased set of sites for regional analyses has been widely recognised (see for example Thacker 1996 and references therein). Indeed, one would need to excavate and analyse every existing site in an area to minimise the bias. Furthermore, due to the nature of the current research, further bias is introduced as some selection of sites has been made.

From the outset the intention was to attempt to cover as best as possible both the spatial and temporal distributions of archaeological sites within the chosen research area. As the research progressed and the set of analysed assemblages grew, it soon became evident that there was a high degree of variability among these assemblages and that as many sites as possible would need to be incorporated. Three further selection criteria were, however, still applied. A representative sample of units from different times was chosen from the extensive Elands Bay Cave assemblage; very small assemblages that would not have meaningful artefact frequencies were excluded for the purposes of analysis; and those sites for which only incomplete assemblages exist were omitted due to the impossibility of reanalysing the material myself.

While the research project is focussed on Elands Bay, it was decided worthwhile to devote a section of this dissertation to a comparison of the results with other assemblages from the Western and Northern Cape (Chapter 7). These were chosen subjectively with many being assemblages analysed by myself, and others being selected for their content. Those local sites for which reanalysis was impossible are also briefly discussed there.

4.2 DATING OF THE ASSEMBLAGES

This research relies on numerous radiocarbon dates which have been obtained through the years since archaeological research began in the Elands Bay area. Due to the necessity of being able to accurately order the analysed assemblages chronologically, the individual marine correction factors were calculated for each shell date rather than using the outdated mean value for the South African west coast which some take to be 400 years and others 450. In practice, the correction factor is frequently much higher than either value, with the most recent dates usually having corrections in excess of 500 years.

This correction factor is required because of the ^{14}C reservoir effect which is based on the presence of old carbon in the deep waters of the ocean. Upwelling results in this carbon being incorporated into modern marine organisms living near the surface, such that when dated, they will produce an age older than their real age. The difference is usually referred to as 'the apparent age of sea water' and needs to be subtracted from the radiocarbon date in order to arrive at the corrected date. Through time the extent of upwelling has varied such that the value of the correction factor will also have changed (Woodborne, pers. comm.).

The procedure for calculating the correction factor was carried out using the Pretoria Radiocarbon Calibration program which is supplied with calibration parameters for dates acquired on both terrestrial and marine materials. In order to calculate the correction, the date supplied by the laboratory is entered into the program using the marine calibration parameter. A calibrated date in years AD or BC will result. Using the terrestrial calibration parameter, one then enters random dates until the same AD or BC value is obtained and the

difference between the two calibrated dates is the correction factor applicable to that particular radiocarbon date (Woodborne, pers. comm.).

Unfortunately the Microsoft Windows version of the calibration program only applies to dates younger than 7238 BP for terrestrial dates and 8515 BP for marine dates. As a result, all dates have been left uncalibrated and the single marine date falling beyond this range, that for the unit CRAY from Elands Bay Cave, is also left uncorrected. This date, however, has a large error value and a date on charcoal is also available for the same unit.

Due to the inconvenience of repeatedly presenting uncorrected and corrected dates simultaneously, every date employed in this research is presented in Table 4.1 below, along with its details and the corrected date where necessary. Henceforth only the corrected dates will be quoted in this dissertation and the reader is asked to return to this table if further detail regarding the date is required.

Table 4.1 Radiocarbon dates employed in this research.

Lab #	Site Name	Layer / Unit / Depth	Sample Material	Date	Corrected Date
Pta-4023	BPM	(single layer)	Charcoal	640 ± 50 BP	
Pta-4807	DFM 1	(single layer)	Charcoal	510 ± 40 BP	
Pta-6730	DFM 1	(single layer)	Charcoal	570 ± 50 BP	
Pta-5061	DFM 1	(single layer)	Charcoal	580 ± 50 BP	
Pta-7889	DFM 1	(single layer)	Charcoal	590 ± 50 BP	
Pta-5277	DFM 1	(single layer)	Charcoal	600 ± 40 BP	
Pta-5276	DFM 1	(single layer)	Charcoal	620 ± 50 BP	
Pta-7897	DFM 1	(single layer)	Charcoal	630 ± 35 BP	
Pta-5062	DFM 1	(single layer)	Charcoal	640 ± 40 BP	
Pta-7894	DFM 1	(single layer)	Charcoal	640 ± 40 BP	
Pta-6337	DFM 1	(single layer)	Charcoal	640 ± 20 BP	
Pta-5280	DFM 1	(single layer)	Charcoal	650 ± 50 BP	
Pta-4802	DFM 1	(single layer)	Charcoal	680 ± 50 BP	
Pta-6721	DFM 1	(single layer)	Charcoal	690 ± 50 BP	
Pta-4799	DFM 1	(single layer)	Charcoal	710 ± 45 BP	
Pta-6732	DFM 1	(single layer)	Marine Shell	1030 ± 60 BP	460 BP

Lab #	Site Name	Layer / Unit / Depth	Sample Material	Date	Corrected Date
Pta-5070	DFM 1	(single layer)	Marine Shell	1130 ± 40 BP	614 BP
Pta-5071	DFM 1	(single layer)	Marine Shell	1140 ± 40 BP	637 BP
Pta-5419	DFM 1	(single layer)	Marine Shell	1170 ± 35 BP	676 BP
Pta-6736	DFM 1	(single layer)	Marine Shell	1180 ± 40 BP	656 BP
Pta-5405	DFM 1	(single layer)	Marine Shell	1190 ± 40 BP	647 BP
Pta-6735	DFM 1	(single layer)	Marine Shell	1200 ± 20 BP	647 BP
Pta-4482	DFM 1	(single layer)	Marine Shell	1200 ± 50 BP	647 BP
Pta-6734	DFM 1	(single layer)	Marine Shell	1210 ± 50 BP	653 BP
Pta-6737	DFM 1	(single layer)	Marine Shell	1210 ± 60 BP	653 BP
Pta-6738	DFM 1	(single layer)	Marine Shell	1210 ± 40 BP	653 BP
Pta-5031	DFM 1	(single layer)	Marine Shell	1240 ± 40 BP	690 BP
Pta-5415	DFM 1	(single layer)	Marine Shell	1290 ± 40 BP	782 BP
Pta-4801	DFM 1	(single layer)	Marine Shell	1350 ± 70 BP	865 BP
Pta-8912	DFM 11	(single layer)	Marine Shell	2220 ± 20 BP*	1782 BP
Pta-1815	EBC	NKOM	Charcoal	320 ± 50 BP	
Pta-5813	EBC	MRSB	Charcoal	500 ± 45 BP	
Pta-5595	EBC	JECH	Charcoal	1310 ± 40 BP	
Pta-5820	EBC	POTA	Charcoal	1790 ± 50 BP	
Pta-5810	EBC	LARM	Charcoal	2190 ± 25 BP	
Pta-5805	EBC	RADS	Charcoal	4160 ± 60 BP	
Pta-5313	EBC	SHAK	Charcoal	4370 ± 60 BP	
Pta-1872	EBC	MARO	Charcoal	7910 ± 80 BP	
AA-5832	EBC	MARO	Ostrich Eggshell	8110 ± 90 BP	
Pta-1871	EBC	MARO	Charcoal	8340 ± 80 BP	
Pta-5305	EBC	BURO	Charcoal	8860 ± 90 BP	
Pta-5808	EBC	SOIL	Charcoal	8920 ± 90 BP	
Pta-5824	EBC	GNOM	Charcoal	9510 ± 90 BP	
Pta-0686	EBC	BSP2	Charcoal	9600 ± 90 BP	
Pta-5306	EBC	NEPT	Charcoal	9640 ± 90 BP	
Pta-2592	EBC	CRAY	Crayfish Carapace	9950 ± 270 BP	uncorrected
Pta-2481	EBC	CRAY	Charcoal	10 000 ± 90 BP	
Pta-5336	EBC	FOAM	Charcoal	10 460 ± 80 BP	
Pta-5361	EBC	ASHE	Charcoal	10 560 ± 100 BP	
Pta-0737	EBC	GBAN	Charcoal	10 700 ± 100 BP	
UW-0192	EBC	KAMA	Charcoal	11 070 ± 140 BP	
Pta-6756	EBC	GBS1	Charcoal	11 370 ± 110 BP	
Pta-6757	EBC	GBS2	Charcoal	13 020 ± 130 BP	
Pta-4321	EBC	MOS1	Charcoal	13 600 ± 140 BP	
Pta-2460	EBO	Spit 1, 10 cm	Charcoal	590 ± 50 BP	
Pta-2465	EBO	BM	Charcoal	705 ± 45 BP	
Pta-2469	EBO	Even	Charcoal	1470 ± 50 BP	
Pta-6265	EBO	Speckle	Charcoal	2 920 ± 60 BP	
Pta-4018	HSM	10 cm	Charcoal	990 ± 60 BP	
Pta-8159	HSM	14 cm	Charcoal	965 ± 20 BP	
Pta-4262	HSM	GBS/PS, 65 cm	Charcoal	910 ± 40 BP	
Pta-5605	PKM	1, Latina, 10 cm	Charcoal	570 ± 20 BP	
Pta-5921	PKM	2, Misterio, 15 cm	Charcoal	880 ± 50 BP	

Lab #	Site Name	Layer / Unit / Depth	Sample Material	Date	Corrected Date
Pta-5602	PKM	3, Temprano, 25 cm	Charcoal	2640 ± 60 BP	
Pta-5990	PKM	4, Sh.Gringo, 45 cm	Charcoal	2940 ± 20 BP	
Pta-5604	PKM	6, Penco, 70 cm	Charcoal	3010 ± 60 BP	
Pta-5603	PKM	4, Sh.Gringo, 45 cm	Charcoal	3020 ± 60 BP	
Pta-5923	PKM	6, Penco, 75 cm	Charcoal	3060 ± 60 BP	
Pta-5743	PKM	7, Pancho II, 85 cm	Charcoal	3570 ± 60 BP	
Pta-4062	SC	Ash IV	Charcoal	440 ± 40 BP	
Pta-4042	SC	DBM	Charcoal	840 ± 50 BP	
Pta-4035	SC	Echo	Charcoal	1150 ± 50 BP	
Pta-4033	SC	UDF	Charcoal	2970 ± 60 BP	
Pta-4027	SC	NBI	Charcoal	3510 ± 60 BP	
Pta-6226	SC	NBIV	Organic Sand	3890 ± 60 BP	

* Date obtained for this research.

Sources: Jerardino (1996); Parkington (in prep. Table 2.2); QUADRU (n.d.).

The temporal distribution of these dates provides good coverage for most of the LSA with the obvious exceptions being those periods during which hiatuses occur. Figure 4.1 illustrates the temporal distribution of assemblages from the late Holocene, the time when the majority of archaeological occurrences occur. It is likely that the most recent occupation of the Elands Bay area is represented on many sites by surface material that is usually not dated. Elands Bay Cave and Spring Cave were probably the only sites to have a sufficiently intense late occupation to leave a reasonable quantity of deposit from that time, but unfortunately the latter has had only a very small excavation. Regular colonial use of the Elands Bay area began in 1731 (Sinclair 1980) and with the most recent of the reliable EBC dates from subsurface strata calibrating to 1648 (NKOM, Table 4.1) and 1645 AD (330 ± 45 BP, Pta-5821; Parkington, in prep. b, Table 2.2) it is clear that prehistoric occupation probably continued until white colonists arrived. In addition, at Tortoise Cave, European type glass and copper artefacts in the undated uppermost layers (Robey 1984; Parkington, pers. comm.) tell of indigenous contact and possibly trade with colonists.

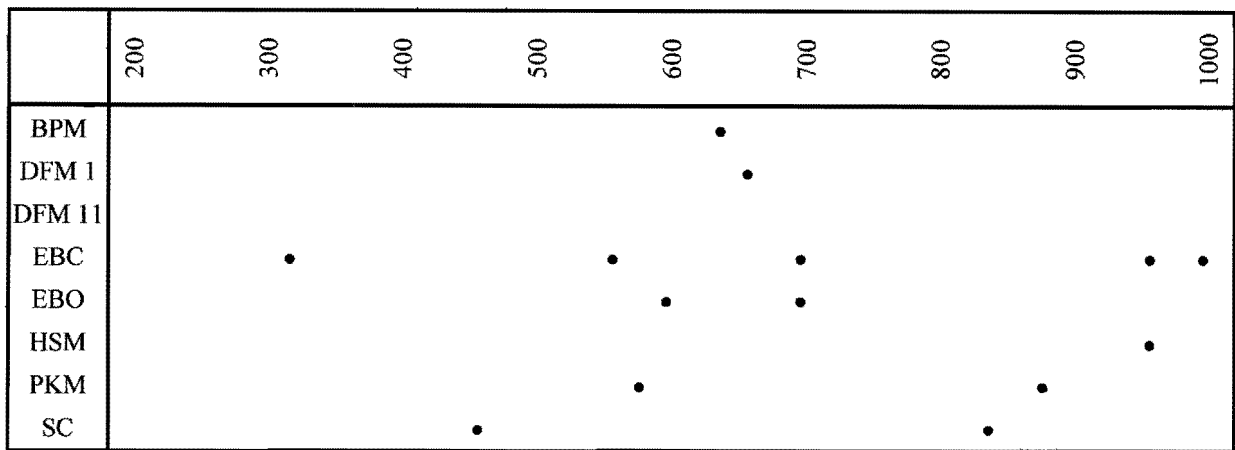


Figure 4.1. Temporal distribution of analysed assemblages from the late Holocene.

In Figures 4.2 and 4.3 the substantial mid-Holocene hiatus is apparent. The DFM 1 assemblage is undated but is thought by its content to belong to the mid-Holocene. If this is indeed the case, it will be the first known assemblage of such an age in the area. Of the analysed sites, only EBC contains assemblages predating this hiatus. These are shown in Figures 4.3 and 4.4. The earliest of these assemblages marks the end of the approximately 4000 year late Pleistocene hiatus.

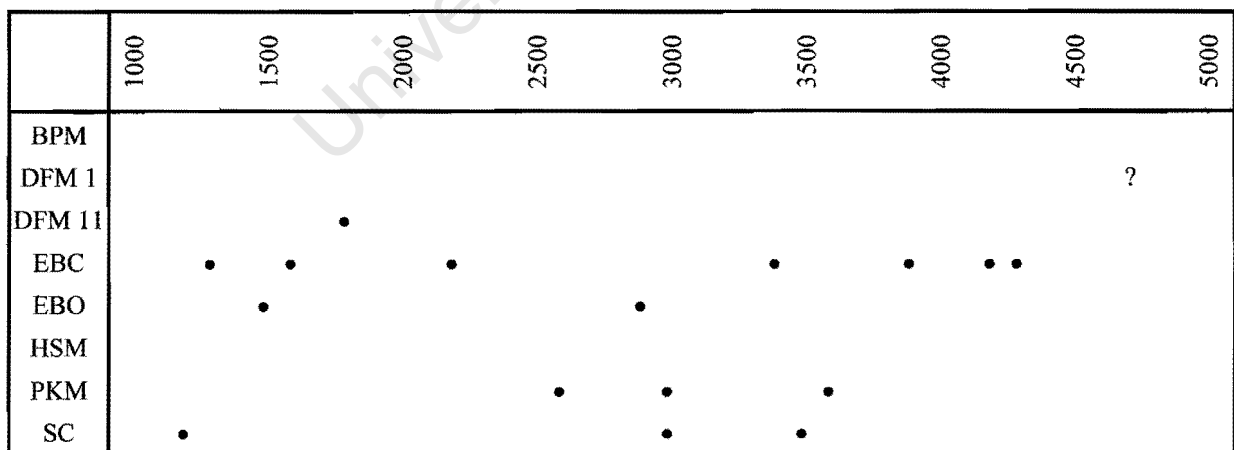


Figure 4.2. Temporal distribution of analysed assemblages from the mid-Holocene to the start of the late Holocene.

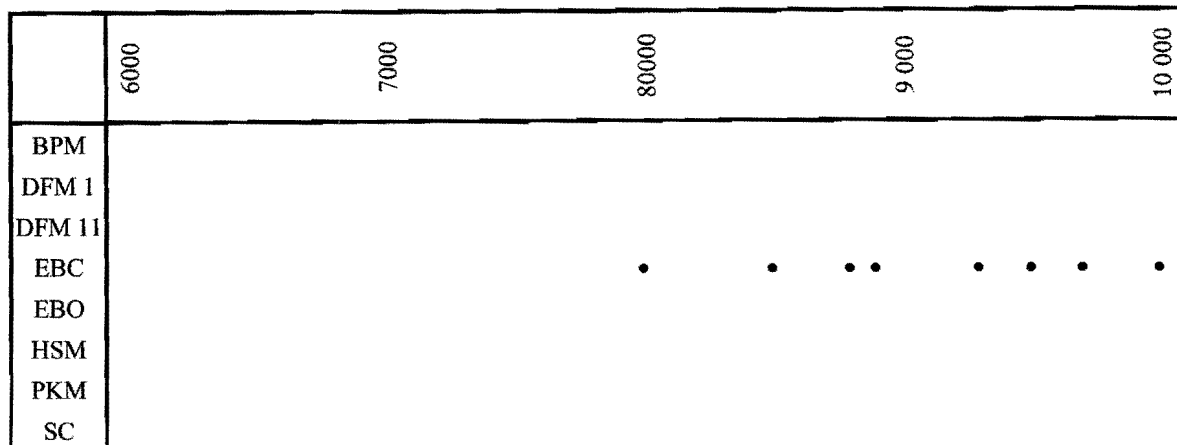


Figure 4.3. Temporal distribution of analysed assemblages from the early Holocene.

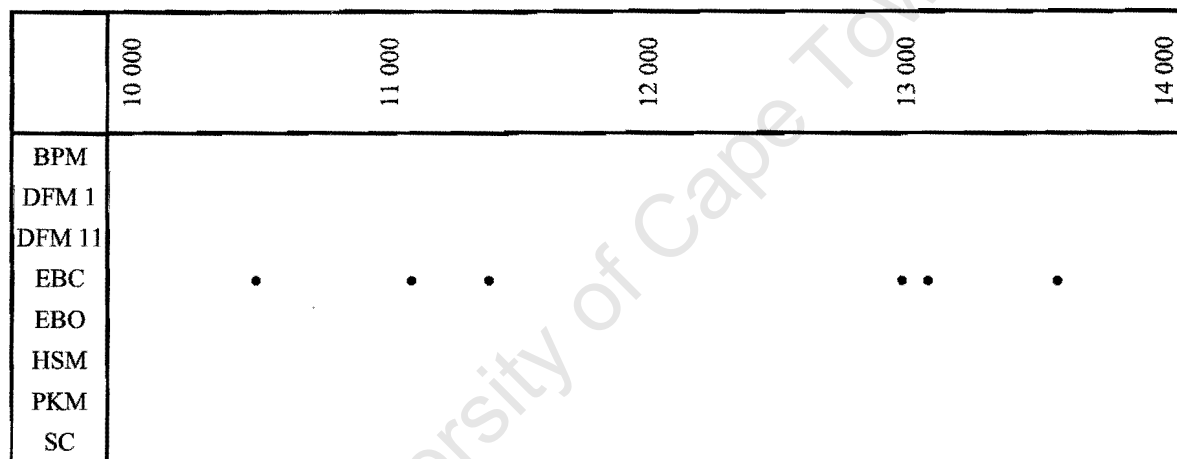


Figure 4.4. Temporal distribution of analysed assemblages from the late Pleistocene.

4.3 INTRODUCTION TO THE SITES

This section introduces each of the examined sites, outlining their stratigraphy, dating and occupational history, as well as mentioning any other factors that may be relevant to the interpretation of the lithic data presented in the following chapters. For those sites with many excavated units, a discussion on the formation of the composite assemblages used in the present analyses is also included. The location of each site is shown in Figure 2.2.

4.3.1 Borrow Pit Midden

Borrow Pit Midden is located at the foot of Baboon Point, out in front of Elands Bay Cave (32°19'05"S 18°19'02"E). The midden was excavated in late 1994 by the University of Cape Town Archaeology Contracts Office, with a total of 12m² being removed. The deposit was disturbed by substantial mole activity, but was deemed to have been the result of a single period of occupation (unpublished field notes). Only one date of 640 BP is available (Table 4.1). This was taken from the single shell lens (Jerardino 1996).

4.3.2 Dunefield Midden 1

Dunefield Midden 1 (DFM 1) is located up against the western edge of the mid-Holocene dune cordon in the duneplume to the north of Elands Bay, some 2 km north of the Verlorenvlei River and about 600 m inland (32°18'04.9"S 18°20'54.0"E). It is an open campsite with a single primary horizon composed of an arc of hearths scattered around the southern, western and northern sides of a central dump. This horizon is superimposed over a yellow water laid gravel which contains a well rounded background lithic scatter of mid-Holocene character (Orton 1998, 2002). Some 770 m² were excavated between 1988 and 1998 resulting in the exposure of what is assumed to be almost the entire area of occupation. One further season of excavation in 2001 removed another 77 m² focussing on the area to the west and south-west of the shell dump with the dual aim of showing that no hearths existed there and of obtaining more of the rounded mid-Holocene artefacts which are most numerous in that area. The deposit ranges from about 50 mm to more than 200 mm deep with even greater depths being attained in parts of the main midden.

Altogether 28 dates, ranging from 460 to 865 BP (Table 4.1) have been obtained for DFM 1. With just five dates predating 600BP and only two post-dating 700 BP the range is

reasonably tight with an average value of 650 BP being designated for the site as a whole. The site is thought to represent a number of brief occupations, the remains of which have overlapped to produce the site as we find it today (Parkington *et al.* 1992). Please note that all other published references to Dunefield Midden (without the '1') refer to DFM 1.

4.3.3 Dunefield Midden 11

Dunefield Midden 11 (DFM 11) is another of the many shell midden sites located in the dune plume north of the Verlorenvlei River. It is located near the southern end and on the western side of the mid-Holocene dune cordon some 1.5 km north of the river and about 200 m inland (32°18'22.2"S 18°20'39.8"E) (Figure 4.1). Just one field season has taken place at this site in 1996 resulting in the excavation of 29 m² of deposit (unpublished field notes). Unfortunately no features were uncovered with the result that the lithic density is fairly low over the entire excavated area. One date, corrected to 1782 BP, obtained for this research project, is available (Table 4.1).

4.3.4 Elands Bay Cave

Elands Bay Cave (EBC) is located in the western-most cliffs of Baboon Point (32°19'04.6"S 18°19'04.3"E) (Figure 4.1). The site is the largest in the immediate vicinity of Verlorenvlei with just over 60m³ of deposit having been removed between 1970 and 1978 to a maximum depth of 3.5 m at bedrock (Parkington 1992). Approximately 250 depositional units representing more than 20 000 years worth of deposit were identified. Although almost all these units fall within the LSA, there are four radiocarbon dates among the lowermost units suggesting that the earliest visits to the cave probably occurred during MSA times, at least some 40 – 45 000 years ago (Parkington in prep. Table 2:2).

Altogether, the 65 radiocarbon assessments carried out on these deposits (Parkington, in prep. Table 2:2) come far from covering every unit. As a result, the excavators decided, through careful stratigraphic analysis and comparison of the makeup and content of each unit, to extrapolate the available dates across the entire site such that all units could be assigned a 'relative' absolute date (Parkington, pers. comm.). This allowed occupational pulses and packages to be defined, as well as highlighting a number of noticeable hiatuses (Parkington, in prep. Table 2:1). Of particular reference to this research are the hiatuses occurring from 17 800 to 13 600 BP, from 7910 to 4370 BP and from 3290 to 2190 BP. All dates from units analysed here are included in Table 4.1.

In addition, through careful consideration of the excavation, stratigraphy and dating, it was also noted that two further relatively minor hiatuses may have occurred (Parkington, pers. comm.). The first of these, from 11 370 to 13 020 BP, does, however, bracket two radiocarbon dates. These were taken from spits in a deep sounding rather than from coherent excavated units and may possibly be unreliable. The latter hiatus, from 2190 to about 1750 BP also contains two dates, but these are from two of a group of units occurring just below the surface (Parkington 1992, Fig. 3a) and thought by the excavators to be much younger (Parkington, pers. comm.).

The excavated stratigraphic units selected for analysis are listed in Table 4.2 along with the occupational pulses and their constituent packages as assigned by the excavators. The radiocarbon dates are entered alongside the units from which they were obtained. The groupings employed in the creation of the assemblages included in the current work are shown along with the dates I have assigned to each. These dates are essentially rough means attempting to represent the units contained within each group and as such should not be seen

as absolute dates, since they are meant merely to identify each assemblage and give it a relative temporal position.

Table 4.2. Analysed units from Elands Bay Cave showing the dated units and the assemblage compositions used in this research.

Unit name	Unit acronym	Pulse*	Package*	Date**	Assigned unit age*	Assigned assemblage age
Ian Smith	IANS	A	2A		320	
Nkomo	NKOM	A	2A	320 BP	320	320 BP
Selassie	SELA	A	2A		320	
Sithole	SITH	A	2A		320	
Mrs Balls	MRSB	A	2B	500 BP	500	
Roberto	ROBE	A	2B		550	
Mobutu	MOBU	A	2B		550	550 BP
Neto	NETO	A	2B		550	
Samora Machel	SAMO	A	2B		550	
Sengana	SENG	A	2B		550	
Smith	SMIT	A	4C		650	
Potato	POTA	A	4C	1790 BP	650	
Grey Potato	POTG	A	4C		650	
Matanzima	MATZ	A	4C		700	700 BP
Salty Potato	POTS	A	4C		700	
El Chama	ELCH	A	4C		750	
Base of El Chama	BAEC	A	4C		750	
Dolly	DOLL	A	3A		950	
Cassius Clay	CCLA	A	3B		1000	1000 BP
George Best	GEOB	A	3B		1000	
Jesus Christ	JECH	A	3D	1310 BP	1350	1310 BP
Dorothy Lamour	DOLA	B	5A		1550	1550 BP
Louis Armstrong	LARM	B	5C	2190 BP	2200	2190 BP
Neo Nyerere	NENY	C	6		3400	
Nyerere	NYER	C	6		3400	3400 BP
Elephant	ELEP	C	9		3900	
Hippo	HIPO	C	9		3900	3900 BP
Rhino	RHIN	C	9		3900	
Sans Souci	SASO	C	9		3900	
Dido	DIDO	C	7B		4150	
Radie Smit	RADS	C	7B	4160 BP	4150	4160 BP
Judo	JUDO	C	9		4200	
Karate	KARA	C	9		4200	
Kung Foods	KUFO	C	9		4200	
Dingaans	DAAN	C	9		4300	4300 BP
Nefertiti	NEFE	C	9		4300	
Tutankhamen	TUTA	C	9		4300	
Shaka	SHAK	C	9	4370 BP	4350	
Olive	OLIV	D	10A		8000	
Spassky	SPAS	D	10A		8000	
Winnie Kriel	WINK	D	10A		8000	8000 BP
Maroon Robeson	MARO	D	10A	7910 BP 8110 BP 8340 BP	8100	

Unit name	Unit acronym	Pulse*	Package*	Date**	Assigned unit age*	Assigned assemblage age
Pele	PELE	D	10C		8500	
Webb	WEBB	D	10C		8500	8500 BP
White Robeson	WIRO	D	10B		8600	
Burnt Robeson	BURO	D	10B	8860 BP	8850	
Limpet Robeson	LIRO	D	10B		8850	
PW Botha	PWBO	D	10B		9000	
Betty	BETT	D	10D		8750	8800 BP
Brush	BRUS	D	10D		8750	
Maggie	MAGG	D	10D		8750	
Spade	SPAD	D	10D		8750	
Hole Contents	HOCO	D	11A		8900	
Soil	SOIL	D	11A	8920 BP	8900	
Soil Surface	SOSU	D	11A		8900	8900 BP
Something Else	SOME	D	11A		8900	
Mussel Soil	MUSO	D	11A		8900	
Louis Botha	LOBO	D	13		9200	
Sonny Leon	SOLE	D	13		9200	
Zostera	ZOST	D	13		9200	
Yasmin	YASM	D	13		9400	9300 BP
Gone	GONE	D	13		9400	
Black Lens	BLen	D	13		9400	
Elf	ELFO	D	12		9500	
Top Gnome	TOPG	D	12		9500	
Gnome	GNOM	D	12	9510 BP	9500	
Gnome 2	GNO2	D	12		9500	9500 BP
Hobbit	HOBI	D	12		9500	
Orc	ORC0	D	12		9500	
Brown Soil Below Pele	BSBP	D	13		9550	
Brown Soil Below Pele 1	BSBP 1	D	13		9550	
Brown Soil Below Pele 2	BSBP 2	D	13	9600 BP	9600	
Neptune	NEPT	D	13	9640 BP	9650	9650 BP
Below Neptune	BENE	D	13		9800	
Limpet	LIMP	D	13		9800	
Crab	CRAB	D	14		9950	
Grey Lens adjacent to Crayfish	GRLC	D	14		9950	
Crayfish	CRAY	D	14	9950 BP† 10 000 BP	10 000	10 000 BP
Grey Lens Above Crayfish	GLAC	D	14		10 000	
Flipper	FLIP	D	14		10 050	
Lobster	LOBS	D	14		10 050	
Below Stones	BEST	D	15A		10 500	
Friar Tuck	FRTU	D	15A		10 500	
Maid Marion	MAID	D	15A		10 500	
Foam	FOAM	D	15B	10 460 BP	10 450	
Baade	BAAD	D	15B		10 450	10 550 BP
Bubbles	BUBB	D	15B		10 450	
Oxygen	OXYG	D	15B		10 450	
Ashes	ASHE	D	15B	10 560 BP	10 600	
Gordon Banks	GBAN	D	15B	10 700 BP	10 700	
Karl Marx	KAMA	D	16A	11 070 BP	11 050	11 070 BP

Unit name	Unit acronym	Pulse*	Package*	Date**	Assigned unit age*	Assigned assemblage age
Gordon Banks 1A	GB1A	D	16C		11 370	
Gordon Banks 1C	GB1C	D	16C		11 370	
Grey Brown Series 0	GBS0	D	16C		11 370	11 370 BP
Grey Brown Series 1½	GBSH	D	16C		11 370	
Grey Brown Series 1	GBS1	D	16C	11 370 BP	11 370	
Grey Brown Series 2	GBS2	D	17A	13 020 BP	13 020	13 020 BP
Orange Black Series II	OBS2	D	18A		13 100	13 100 BP
Mottled Series 1	MOS1	D	20A	13 600 BP	13 600	13 600 BP

* According to Parkington (in prep. b, Table 2.1) ** Source: Parkington (in prep. b, Table 2.2)

† Uncorrected marine date.

My original selection of units to analyse from EBC was based on a number of factors: compromised or disturbed units were excluded; units containing too few artefacts and which could not be meaningfully combined with other units were excluded; and where one or two units contained a large number of artefacts, smaller units were ignored for the sake of avoiding dilution of the data by units which may not really be firmly associated with an otherwise securely dated assemblage. Despite these criteria, every effort was made to produce a selection of assemblages that would be temporally well-placed to give good coverage of the LSA occupations of EBC. It is also hoped that through combining units the assemblages used here would be less susceptible to the kind of inter-layer mixing of artefacts demonstrated by Villa and Courtin (1983) and discussed in Section 3.1.4 above.

After examining each unit individually, a number of revisions to the Parkington (in prep.) layers were made as follows:

- Package 9 contains a range of dates based on the 4370 BP from Shaka and the 3940 ± 60 BP (Pta-5317) from BARH (unit not analysed here) which overlap with Package 7B. As a result, Package 9 was split into two with 7B, dated to 4160 BP, being inserted in between.
- Packages 10B and 10D were combined on the basis of their overlapping dates. 10D contains rather few artefacts and in the only unit where a reasonable number of artefacts is present (BRUS) there did not appear to be any significant difference between it and 10B.

- Package 13 was split into two based on the range of dates incorporated within the package and the fact that package 12 is dated to the middle of this range. Package 12 appeared to fit well between the two portions of package 13, further justifying the subdivision.

- Packages 15A and 15B were combined due to the overlap in dating. The fact that 15A contains rather few artefacts meant that no significant changes would occur in the data.

Further alterations were considered, but due to some small assemblages and the desire to limit the number of assemblages, some confidence was placed on the judgements made by those who originally compiled the package subdivisions and no further changes were made. Three further possibilities were borne in mind during the final data analyses but not effected, since none of the relevant assemblages seemed problematic:

- Separation of ELCH and BAEC from the rest of 4C on the basis of the difference between the 1790 BP date on POTA and the 2100 ± 20 BP (Pta-5611) date on KEPL (not analysed here) which overlies ELCH;

- Maintaining the separation of 15A and 15B. This was not done as 15A has a very small sample size. Omitting 15A was another option here; and

- Separating GBAN from the rest of 15B.

Another issue needing mention is the dating of those units allocated by Parkington (in prep., Table 2:1) to his Package 4c. Two radiocarbon dates suggest the units in this package to be some 2100 to 1800 years old, but on the basis of their archaeological content, it has been suggested that these units should actually be about 700 years old (Parkington, pers. comm.). For the purposes of this analysis they are retained in the position suggested by Parkington but their temporal position is explored in greater detail in Section 5.8.

4.3.5 Elands Bay Open

The site of Elands Bay Open (EBO) is an open shell midden banked up against boulders at the base of Baboon Point some 70m north-west of EBC (32°19'02.1"S 18°19'03.4"E) (Figure 4.1). It is fairly unique among open middens in that it is not located on a sand dune but rather on the rocky lower slopes of the mountainside. The primary excavation was carried out in 1978 when an area of 14 m² was opened (Horwitz 1979). In 1994 three more square metres were opened with new stratigraphic names being used. All the excavated units have been combined into four layers with each being named according to its appearance, 'Even' referring to the fact that that unit was even more brown than the one above it (Horwitz 1979).

The layers and their dates are indicated in Table 4.3, while the original radiocarbon dates are presented in Table 4.1. Each layer consisted of one primary stratigraphic unit with smaller lenses contributing the remaining material. The exception was layer one, which comprised two spits and a number of other small units (Horwitz 1979). These primary layers are retained and form the assemblages used in this research with the single radiocarbon date available for each being taken as representative of the layer.

Table 4.3. Layers and dates from Elands Bay Open.

Layer	Layer Name	Date
1	Yellow Midden	590 BP
2	Brown Midden	705 BP
3	Even	1470 BP
4	Speckled	2920 BP

Sources: Horwitz 1979, QUADRU (n.d.).

Unfortunately this is not ideal since the 705 BP date comes from a hearth lying at the top of Brown Midden (Horwitz 1979), such that the date represents the very latest part of layer 2 leaving the possibility that this date might be the start of the layer 1 occupation thus potentially leaving layer 2 undated. The available dates do, however, still suggest a sporadic occupation of the site, with the 2900 to 1500 BP hiatus being temporally similar to that at EBC, but extending for a longer period.

4.3.6 Hailstone Midden

Hailstone Midden (HSM) is a stratified shell midden with deposits reaching a maximum thickness of 670 mm (Noli 1988). The site is a massive midden capping a dune located below the cliffs some 100m from the southern edge of Elands Bay (32°19'06.9"S 18°19'18.2"E) (Figure 4.1). During 1986 a 6m² excavation was conducted, while a small test pit had previously been dug in 1979. Although five stratigraphic units were identified during the excavation, dates of 990 BP from just below the surface of the test pit and 965 BP and 910 BP from below the surface and from the base of the excavation respectively (Table 4.1) indicate that the midden was probably deposited over a very short period just after 1000 years ago (Noli 1988). As a result of these dates and the small size of the lithic assemblage, all stone artefacts were analysed as a single assemblage and allocated a date of 950 BP. A substantial amount of pottery is present on the surface of the midden.

4.3.7 Pancho's Kitchen Midden

The site of Pancho's Kitchen Midden (PKM) is an approximately 1 m deep stratified shell midden in front of a large boulder at the very base of the cliffs of Bobbejaansberg. It lies at the foot of a valley leading up into the mountain, some 2 km south of the mouth of the Verlorenvlei River (32°20'20.4"S 18°19'57.6"E) (Figure 4.1). Almost all of the deposits are

located on the talus slope outside the tiny south-west-facing shelter and were excavated in seven stratigraphic layers dating back just over 3500 years (Jerardino 1998).

PKM is one of only two rockshelter or cave sites in the Elands Bay/Lamberts Bay area known to contain significant deposits dating to the third millennium BP (Jerardino 1998), the other being Steenbokfontein Cave (Jerardino & Yates 1996). As such the site is important in that the 2000 to 3000 BP period is one in which large open shell middens dominate the landscape, with most shelters and caves experiencing a hiatus in occupation at this time (Jerardino & Yates 1996).

As with many sites in the area, PKM has also experienced a significant hiatus with a period of at least 1500 years seeing the site unoccupied. No less than five layers of deposit occur through the first 1000 years of occupation, indicating a fairly intense spell of occupation centred around the middle three of these layers which all date close to 3000 BP. This period ended some 2600 years ago, following which two further layers only provide evidence of reoccupation during the last millennium BP (Jerardino 1998).

Table 4.4 lists the seven stratigraphic layers from PKM as proposed by the excavators (Jerardino 1998) and the units from which the dates were taken. Although layer 5 is undated, the presence of almost contemporaneous dates in layers 4 and 6 show that it too must date to the same period. This situation led to the combination of all three layers as a single assemblage with the remaining four layers each forming their own assemblages as shown in Table 4.4.

Table 4.4. Layers and dates from Pancho's Kitchen Midden.

Layer	Dated Unit	Date	Assigned Assemblage Age
1	Latina	570 BP	570 BP
2	Misterio	880 BP	880 BP
3	Temprano	2640 BP	2640 BP
4	Shelly Gringo	2940 BP	
		3020 BP	
5		undated	3000 BP
6	Penco	3010 BP	
		3060 BP	
7	Pancho II	3570 BP	3570 BP

Sources: Jerardino (pers. comm.); QUADRU (n.d.).

4.3.8 Spring Cave

The site of Spring Cave (SC) is located fairly high up at the base of the cliffs on the northern flanks of Bobbejaansberg and commands a spectacular view over the entire area north of Elands Bay ($32^{\circ}19'21.9''S$ $18^{\circ}19'48.9''E$) (Figure 4.1). The site has a permanent spring located at the back of the cave and makes an ideal occupation site since the river water from Verlorenvlei is brackish. Testimony to this is the fact that the few other caves extending to the west of SC also contain deposits. Stone raw materials are abundant here as the cave has been carved out of a pebble-rich band of the Piekenierskloof conglomerate (cover photograph) and in many places along the foot of the cliff these pebbles are actively eroding from their matrix and would have been easily collectable.

One season of excavation in 1984 resulted in two squares, one at the mouth and one at the rear of the cave, being excavated to bedrock. The former reached approximately 1.15 m while the latter attained a depth of 0.75m (unpublished field notes). These two squares were

effectively only a test excavation and with such a large deposit being present the site actually needs a larger excavation if it is to be properly understood (Yates, pers. comm.). The site is still considered to be consistent with Tortoise Cave and Elands Bay Cave (Parkington, pers. comm.), both of which have undergone far more substantial excavation.

In all, 42 units were excavated among the two squares (unpublished field notes) and by combining the data from both squares a possible sequence of some six to eight layers has been worked out (Jerardino & Yates, pers. comm.). Unfortunately the two squares are located four metres from each other, making it difficult to reliably relate the strata in the two holes.

Table 4.5 shows the excavated units and available dates from each square indicating the suggested groupings mentioned above. The solid lines indicate likely layer divisions while the dashed lines show two further possible subdivisions. Due to the unreliability associated with this sequence, I have elected, through a combination of shell data and lithic density, to create samples associated with the available dates and which do not combine material from the two squares, thereby maximising the possibility of temporal validity among the samples. This does, however, result in two of the four assemblages being quite small. The surface assemblage from square D9 was included in the 460 BP sample as there is a good chance that the final occupation of the cave was not very long after that time and also, without it the assemblage size would be very small. The units selected for inclusion in each assemblage are indicated by the playing card symbols and the single available date for each is taken as being representative of the sample. Two further dates were obtained. One is from Echo, midway through the sequence, while the other, taken from Next Black IV, indicates that the cave was first visited some 3900 years ago. Table 4.1 shows all the radiocarbon dates from the site.

Table 4.5. Layers, units and dates from Spring Cave.

	Unit	Square	Date
♣	Surface	D9	
	Crust	D9	
	Surface	I9	
♣	Ash I	D9	
♣	Ash II	D9	
♣	Ash III	D9	
♣	Ash IV	D9	460 BP
	OL I	D9	
	Shelly Loam	D9	
	HBSL	D9	
♦	VOL	D9	
♦	H. betw. OL's	D9	
	HBS	I9	
	YM	I9	
	BYM	I9	
♦	OM I	D9	
♦	OM II	D9	
♦	DM I	D9	
♦	DM II	D9	
♦	DBM I	D9	840 BP
♦	DBM II	D9	
	HBBYM	I9	
	Alpha	I9	
	Bravo	I9	
	Charlie	I9	
	Delta	I9	
	BS	D9	
	DLWS	D9	
	Soil with Shell	D9	
	Echo	I9	1150 BP
	Foxtrot	I9	
♥	Roots	I9	
♥	Grass	I9	
♥	UDF	I9	2970 BP
♠	All Black	I9	
	Sand in All Black	I9	
♠	BM	I9	
♠	BBM	I9	
♠	BBM under rock	I9	
♠	NB I	I9	3510 BP
	NB II	I9	
	NB III	I9	
	NB IV	I9	3890 BP
	BS above Bedrock	I9	

Sources: unpublished field notes, Jerardino & Yates (pers. comm.), QUADRU (n.d.).

5 RESULTS OF THE LITHIC ANALYSES

5.1 INTRODUCTION

In this chapter the results of all the lithic analyses conducted during the course of this research are presented graphically. In all, 43 assemblages covering the last 13 600 years were analysed. These assemblages come from eight different sites with 25 being from Elands Bay Cave. Each graph presents all the assemblages simultaneously in chronological order from oldest to youngest and discussion of change always follows this ordering. Due to the size and number of graphs incorporated in this chapter, the largest ones (Figures 5.1 – 5.47, 5.49 – 5.55) are appended in a separate volume as Appendix 4 to allow for easier examination alongside the text. The original raw data are in Appendix 5.

The first section (5.2) analyses the raw material proportions, while the following four examine the cores, débitage, edge-damaged pieces and formal tools respectively. In keeping with the aims of the project, the data are presented by raw material as much as possible, with the focus being on quartz. Only general interpretations are offered here, with further detail provided in Chapter 6.

Where applicable, typological data involving total assemblage counts have been presented both with and without chips due to the problems described in section 3.1.5. This is indicated on each figure as appropriate. Bars are generally used to show data exclusive of chips while points or lines and points show the data inclusive of chips. The chips are felt to have a less important impact on the overall raw material frequencies and these totals thus still include chips.

Owing to the variety in assemblage size, some assemblages produce somewhat unreliable data. Figure 5.1a shows the total size of each quartz assemblage while Figures 5.1b and c show the same in greater detail. The latter graph shows that seven assemblages have fewer than 100 quartz artefacts excluding chips. These assemblages are perhaps the most likely to yield spurious results for most calculated values. Due to the overwhelming dominance of quartz, the remaining raw materials almost all have small assemblage sizes. Quartzite, as the second most common material, only has 7 assemblages with more than 100 artefacts (excluding chips) while the combined total of all the other raw materials only exceeds 100 artefacts in eleven instances (Figure 5.2).

5.2 RAW MATERIALS

The raw material proportions presented in this section are all based on the entire assemblage, including chips. However, all figures show the data both with and without the chips.

5.2.1 Quartz

In many parts of southern Africa, during the LSA, quartz is the most common raw material used, although some areas, such as the Karoo (Sampson & Sampson 1967; Sampson 1970) and Lesotho (Mitchell 2000a), are dominated by other materials. In Elands Bay the former trend is very strongly evident (Figure 5.3) with the overall average proportion of quartz being 81.3% (including chips). During the earliest part of the LSA represented at Elands Bay (13 600 to 13 020 BP) quartz comprises just under 80% of the total number of artefacts, but then begins to drop markedly until 10 000 BP when it constitutes only a little over 50%. Soon afterwards values of over 80% are again achieved and maintained through to the present.

There are many minor changes throughout this period and some may be a partial result of the poorer sorting and sieving procedures carried out in the earlier excavations (Section 3.1.5). Indeed, the three sites which probably have the most reliable chip counts, DFM 1, DFM 11 and PKM, generally have the highest proportion of quartz as well. In Figure 5.3 the bars represent the proportion of quartz with all chips excluded from the sample, while the diamonds show the same value inclusive of all chips such that one can ascertain just how much effect this factor has on the data. From the figure it is clear that all the values have dropped slightly, meaning that of all the raw materials, quartz contributes the greatest proportion of chips. Owing to its having been predominantly flaked in a bipolar manner, this is to be expected (Appendix 1).

5.2.2 Quartzite

Other than sandstone, quartzite is certainly the most accessible raw material in Elands Bay, but due to its not being conducive to the manufacture of microlithic artefacts it is not used as frequently as quartz (Figure 5.4). It is still, however, the second most commonly flaked raw material in the total sample, despite its average proportion at Elands Bay only being 7.7% of all artefacts. There is considerable range in this figure, with quartzite forming only about 5 to 6% during the earliest part of the research period, then increasing to a maximum proportion of about 26% around 9800 years ago. Thereafter a rapid decrease sees quartzite representing only some 4 to 7% of each assemblage until just after 3000 years ago when the lowest frequencies are consistently evident. From 1470 BP one sees a far more irregular pattern which continues until the present.

5.2.3 Other raw materials

Materials other than quartz and quartzite generally maintain relatively low proportions throughout the LSA in Elands Bay. In other parts of South Africa, where silcrete and cryptocrystalline silica are common, they are used with far greater frequency and can even dominate quite strongly. For example in the Phuthiatsana ea Thaba Bosiu Basin in Lesotho, quartz only reaches 10% once through 7500 years of the LSA with CCS forming 65 to 90% of all assemblages (Mitchell 2000a, Figure 2) . Despite the low proportions of each individual other material at Elands Bay, they still make up a reasonable proportion of the overall assemblages when combined (Figure 5.5). It is clear that these materials played a far more important role between 13 100 and 8900 BP than at any other time. At 13 600 BP little importance was accorded them despite all being present. Immediately afterwards we see a dramatic rise in the use of these materials, which continues unabated until 8900 BP when they once more dramatically decrease. Only two assemblages contain low proportions before the values increase again, also becoming somewhat variable, until 1000 BP. After this date the assemblages can be divided into two groups with the first showing consistently lower proportions of all materials other than quartz and quartzite and continuing until 570 BP. The last three assemblages all contain higher proportions again.

It is perhaps interesting to note that the EBC assemblages consistently seem to contain less quartz and quartzite than those from other sites, a pattern shown more clearly in the higher proportions of other materials than in the values for quartz and quartzite.

Silcrete is an excellent material for stone working, but is used surprisingly little in Elands Bay. This is most likely a result of there not being any known sources of good quality fine-grained silcrete in the immediate area (Roberts, pers. comm.). Sources of silcrete are known

to occur a few tens of kilometres away, both to the north (De Beer *et al.* 2002) and to the south-east along the Verlorenvlei River (Poggenpoel, pers. comm.), although we cannot tell whether these were visible and available for exploitation during the LSA. Interestingly, at Scorpion Shelter, some 8 km to the south, we see a consistent presence of approximately 9 to 11% silcrete throughout (Wahl 1994, Appendix B), possibly indicating the presence of a source not too far away. At Diepkloof Rockshelter, 15km up the Verlorenvlei River from Elands Bay, silcrete comprises between 75% and 80% of the raw materials in the Howiesons Poort MSA deposits, while in the most recent MSA levels, this figure drops to around 25%, with quartz dominating the remainder (Poggenpoel, in prep.). This decrease is thought to represent changes in artefact-making, possibly linked to hunting techniques, rather than the loss of the source (Poggenpoel, in prep.). The silcrete has been sourced to an outcrop in the Sandveld some 15 km north of the site (Poggenpoel, pers. comm.), and being away from the river, and still visible today, one would expect this outcrop to have remained available for exploitation throughout the ensuing LSA. It seems then, that in general, the willingness to travel in search of materials declined with time, perhaps culminating in the extremely low values evident in the late Pleistocene at Elands Bay (Figure 5.6) and Faraoskop (Manhire 1993). Despite the lack of obvious sources near Elands Bay, the people there were still accessing and using small quantities of this stone throughout the LSA, as confirmed by the frequencies reflected in Figure 5.6. Curiously, silcrete shows a relatively consistent presence until 2200 years ago, while after this time, all the Elands Bay Cave assemblages contain more than 4.8% silcrete with all others containing less than 2%.

Cryptocrystalline silica is probably the best raw material to work with due to its reliable and predictable conchoidal fracture. Like silcrete, however, it is not widely available in the Elands Bay area, and therefore has only been used in very limited quantities (Figure 5.7).

Interestingly, CCS frequencies show a similar pattern to that of silcrete with a fairly persistent presence until 3000 BP after which it is used somewhat more sporadically than silcrete. Again, Elands Bay Cave shows more consistent use than any other site. Both raw materials show a markedly low frequency at 8800 BP and a high frequency at 13 100 BP. The dramatic increase shown by silcrete at 8000 BP is not reflected by CCS, however, with the latter exhibiting a gradual increase.

Sandstone is another seldom flaked raw material (Figure 5.8), in this case not due to lack of availability, but rather due to its poor quality. Besides the difference in quality, sandstone and quartzite are similar in many respects. As such, their frequencies do mirror each other to a certain degree, with spikes and troughs frequently occurring simultaneously. The 10 550 to 8900 BP period shows the greatest frequencies of sandstone. Thereafter, with few exceptions, low proportions are maintained.

Interestingly, the 2970 BP Spring Cave assemblage shows a very high frequency of both quartzite and sandstone. It is the only assemblage between 8800 and 1550 BP to show such high values for either material. Before 8800 BP high proportions of these materials are expected. It is possible that the reason for the high incidence of these lower quality materials is to do with accessibility, since this site lies fairly high up on the mountainside. Although the 3510 and 840 BP assemblages from Spring Cave do not show similar proportions, the most recent 460 BP assemblage does reflect the same situation quite strongly, so some other factor must have also played a role. At EBO the 1470 BP assemblage shows a similar trend, also without any apparent explanation. Interestingly, in each of the three occasions since 8000 BP when sandstone makes a particularly high showing, it is matched quite strongly by quartzite.

With sandstone and quartzite being similar materials, but representing opposite ends of the quality spectrum, one would expect to see quartzite being more prominent in the lithic assemblages. Figure 5.9 shows the ratio of sandstone to quartzite such that values greater than 1, indicating dominance of the former, presumably point to less concern with raw material quality on the part of the stoneworkers. The situation reflected in the graph is an interesting one in that there is much variation through most of the period examined, but with the 1350 to 550 BP period showing remarkably little use of sandstone relative to quartzite. The exceptionally high value for DFM 11 is probably more a result of the unusually low value for quartzite at this site rather than a high sandstone component and may simply be a function of excavational bias.

FGB rocks show a pattern unlike that of any other material. It seems that these rocks were relatively commonly used prior to about 3900 years ago, but then seldom used thereafter (Figure 5.10). The pattern of reduced quartz usage between 13 000 and 9000 BP is strongly reflected in the greater proportion of FGB rocks at this time. In fact during this period these rocks achieve fairly high proportions, thus justifying their separation from the remaining 'other' materials. One curious feature of this material is that it appears at two sites only, EBC and DFM 1. Why it should never have appeared at any of the other sites remains a mystery. The location of sources is unlikely to be a suitable explanation for its absence, since EBC is more or less central in the distribution of sites used in this research. Larger samples could, however, result in the presence of this material in a few more assemblages. Furthermore, in EBC, it appears in every single assemblage except that from 550 BP, although this latter is quite small so complete exclusion cannot be guaranteed. This must suggest a local source for these rocks, but this does not explain the occurrence of them at DFM 1.

The final raw material category, 'other' (Figure 5.11), displays a very similar pattern to the FGB rocks, except that it makes a slightly greater showing in the post-3900 BP assemblages. These 'other' rock types demonstrate a sporadic, but relatively regular occurrence, as is to be expected, although, variation is present throughout. Most variation, however, is likely to be due to the relatively small number of pieces in these materials in conjunction with relatively small overall assemblage sizes. It is interesting to note that at EBC the FGB rocks and remaining 'other' rock types invariably occur in similar proportions, suggesting that they may not have been sourced and collected independently, but rather collected at the same time as alternatives to the usual materials. An interesting comparison can be drawn between Spring Cave and Pancho's Kitchen Midden, both of which contain multiple stratified assemblages dating to similar periods. Spring Cave only contains 'other' materials after 1000 BP, while Pancho's only has them before 2500 BP.

5.3 CORES

The proportion of cores found among the quartz assemblages under study is shown in Figure 5.12. A reasonably high proportion of quartz cores ranging between 6 and 10% is maintained until about 3900 BP and then again from around 2640 years ago, but with the latter period being more variable and on average containing around 4 to 7% cores. The intervening years suggest a greater efficiency in the reduction of quartz cores as shown by Figure 5.13 which points to a greater yield of quartz flakes and blades and of chunks per core during this time. Quartz cores are typically dominated by bipolar cores with irregular and single platform cores making up most of the remainder (Figure 5.14). Only occasionally and rather sporadically do single platform bladelet cores appear.

The significant dominance of bipolar cores may be the result of several factors. Firstly, quartz bipolar cores tend to break quite often, either through striking them on their sides when they fall over on the anvil or simply due to the presence of natural fracture planes within the quartz. In these instances both ends might be classified separately as bipolar cores, hence inflating the count. Secondly, the working of a single nodule of raw material can quite easily produce more than one bipolar core. This would occur when initial striking causes the nodule to break into a few large pieces with each being treated as a separate nodule of raw material. As a result, the flake to core ratio would be lower since other flaking techniques on similar nodules might result in continuous flaking from just one core. This could be part of the reason for the lower overall core counts during the 3570 BP to 2920 BP period, when bipolar cores are slightly less common. Of course, small assemblage sizes make detailed interpretations difficult.

Quartzite cores are perhaps too infrequent to enable accurate interpretation of patterns (Figure 5.15), but there is clearly an absence of cores between 2970 and 1550 BP, a period when, with the exception of the 2970 BP assemblage, quartzite was consistently at its lowest. Figure 5.16 shows the yield of quartzite flakes and blades and chunks per core. Clearly far more quartzite flakes, blades and chunks were produced during the early part of the Later Stone Age, with the ratio dropping off significantly from about 9300 BP. The very high yields compared to quartz may suggest that quartzite cores started out much larger than cores in other materials. Several zero values, reflecting a lack of cores, make further interpretations difficult, although, as noted by Humphreys (1972), one core in those assemblages could hypothetically have yielded all the flakes present. As such, these assemblages must also be seen to have very high artefact yields per core.

Graphs were not produced for the cores in other raw materials as the small assemblage sizes and resultant sporadic nature of the data made it futile to attempt any meaningful interpretations from them. We would expect the artefact yield of quartzite cores to be higher than those materials only available in smaller pieces, such as quartz, silcrete, CCS and other materials assumed to have been collected in pebble form. Such a pattern has been recognised between hornfels and CCS which occur as dykes and pebbles respectively in central southern Africa (Sampson & Sampson 1967).

5.4 DÉBITAGE

Débitage makes up the largest proportion of all lithic assemblages and of those raw materials commonly used in tool manufacture (i.e. quartz, silcrete and CCS), quartz, due to its usually being flaked in a bipolar manner, typically shows the highest proportion of débitage. Those materials relatively seldom used in tool manufacture (i.e. quartzite, sandstone, FGB rocks and 'other') usually show very high proportions of débitage. Figure 5.17 shows the quartz débitage both including and excluding chips. It is quite clear that the inclusion of chips results in a greater débitage proportion and if proper recovery of all chips had consistently taken place these values would have been even higher.

Due to the sometimes extremely small assemblage size in each of the other raw materials, the data do not accurately reflect the true proportions of artefacts in these materials. However, some patterning is still evident. Quartzite shows the high débitage proportions one would expect from a coarse-grained rock (Figure 5.18), while the lower proportions of silcrete and CCS débitage (Figures 5.19 and 5.20) reflect the fact that these higher quality materials are more often put to further use, either with or without retouch. Sandstone is usually very coarse-grained and does not produce sharp edges. As such, almost all the sandstone artefacts are

débitage (Figure 5.21). FGB rocks are slightly more conducive to being used, which results in their débitage proportions (Figure 5.22) being slightly lower than those of the remaining 'other' materials (Figure 5.23).

Figures 5.24 and 5.25 show the proportion of flakes and chunks in the quartz assemblages, while Figure 5.26 combines these data into a ratio. Distinctions between flakes and chunks will always differ between analysts and one's perception of what constitutes a flake can also change over time and with increasing experience, something I have experienced in my own work. For both this reason and the inconsistencies produced by some of the smaller assemblages, the ratio of flakes to chunks is not always meaningful. Figures 5.24 and 5.25 show the general trends of decreasing flakes and increasing chunks over time, while Figure 5.26 makes this relationship clear but also shows the considerable variability from assemblage to assemblage. This average decrease over time is shown more clearly in Table 5.1 which combines the data into five shorter periods in keeping with the divisions identified at the end of this chapter (Table 5.2).

Table 5.1 Mean flake to chunk ratios for quartz.

Period	Assemblages	Mean flake : chunk ratio*
13 600 – 11 370 BP	4	1.80
11 050 – 8500 BP	9	1.44
8000 – 1000 BP	17 [†]	1.35
950 – 570 BP	9	0.82
550 – 320 BP	3	1.21

* Flakes include blades, bladelets & flakes.

[†] DFM 1 (Mid-H.) is omitted as the chunks are excessively over represented due to the rounding effect that is present.

The figures for quartz range between 0.29 and 2.24 while among the other materials even wider ranges, with values between 0 and 8, occur. There is a slight tendency for quartzite and

silcrete and to a lesser degree FGB rocks to have slightly higher proportions of flakes than the remaining materials. Significantly, quartz shows far higher proportions of chunks than the other raw materials, and it can only be surmised that this is due to relatively poor quality quartz having been flaked.

The ratio of blades and bladelets to flakes provides a measure of the degree to which the assemblages were focussed on blade production. Late Pleistocene microlithic, or so-called “Robberg” assemblages are usually strongly focussed on bladelet production, although this is not always the case. In the latter instances, the term “Robberg-like” is often used to describe the assemblages (e.g. Wadley 1997; Mitchell 2000a, 2002a). This industry is thought to have been present in Southern Africa until about 12 000 years ago (Wadley 1993; Mitchell 2002a) in most areas and until just after 10 000 BP in the south-eastern parts of southern Africa (Mitchell 2002b). Figure 5.27 shows that at Elands Bay blades comprise a very small proportion of all flakes with few assemblages producing blades in any significant amount. Wadley (1993) points out that this ratio can vary greatly among sites with Robberg affinities such that the Elands Bay values would fit into the low end but would not be precluded from the grouping. Faraoskop (Manhire 1993), some 32 km north-east of Elands Bay, contains the only other known late Pleistocene occupation and the low bladelet frequencies from that site suggest that such values were a regional phenomenon (see Chapter 7 below for further discussion).

It is clear from Figure 5.27 that only the 13 600 BP assemblage from Elands Bay Cave has a significant blade component. However, with the exception of the 11 370 BP assemblage, relatively high blade numbers are maintained until 10 550 BP, which suggests that this Robberg-like microlithic tradition phased out around that time at Elands Bay. Interestingly,

during the last 1000 years, in those sites where blades were produced, they were invariably made in fairly high numbers with blade proportions of 4 to 7% being encountered.

Of the other raw materials, only silcrete and CCS have enough blades and bladelets to merit further analysis (Figure 5.28). Both these materials show far greater proportions of blades than is evident in the quartz assemblages. This must be a result of their superior flaking properties. Where blades or bladelets are present, they usually account for at least 10% of flakes. Due to the small assemblage sizes, however, most of these values are the result of only a single bladelet. The lack of silcrete and CCS bladelets in the post-1000 BP assemblages is more a reflection of the lack of these materials generally at this time since the quartz assemblages show relatively high proportions of bladelets.

Barham (1989b:150) has proposed that a blade : core ratio of approximately 1 or less might indicate incidental, rather than purposeful, blade production, although he gives no motivation for choosing this particular value. Figure 5.29 demonstrates that aside from the unreliable, rounded mid-Holocene assemblage from DFM 1, in which many cores may have lost their diagnostic features, only the very earliest quartz assemblage in the current Elands Bay sample comes anywhere close to a ratio of 1. This suggests that even in those assemblages where blades and bladelets were a focus, they were not manufactured with any great intensity. Perhaps people only utilised flaking techniques which were more likely to produce blades rather than actually working specifically towards their production? Even the 650 BP assemblage from DFM 1 shows a very low ratio, despite the fact that almost the entire industry was focussed on the production of backed bladelets. A broad assumption can be made that most backed bladelets are likely to have started out as bladelets. When the blade : core ratio is calculated using the total of backed bladelets and fragments as well as blades and

bladelets the value rises from 0.21 to 0.61 – much greater, but still far from Barham's ideal of 1 for purposeful blade manufacture.

Cores and blades in other raw materials are again too few in number to produce data sets large enough to be analysed. It can be stated, however, that when these artefacts are present, the blade : core ratio in the fine-grained materials tends to be greater than that for quartz. This is certainly a result of the superior flaking qualities of the other materials. Similarly, true blades (≥ 25 mm) in all raw materials are too few in number to make any comparison of blades and bladelets, but it is likely that the former merely represent those which happened to be longest with no deliberate attempts to manufacture large blades having occurred in any of the assemblages.

5.5 EDGE-DAMAGED PIECES

As described in section 3.2.3 edge-damaged pieces are a somewhat miscellaneous collection of items of whose history we cannot be sure. For this reason we may expect the proportion of edge-damaged pieces to be quite random, and to some degree this is the case, although a few short periods of consistency, most notably that at the very end of the Holocene (Figure 5.30) are evident. The raw material proportions among edge-damaged pieces show slightly more consistency, although some assemblages show significantly different patterns than their temporal neighbours (Figure 5.31).

The quartz edge-damaged pieces (Figure 5.32) appear to show slightly stronger temporal patterning than the total for all raw materials with consistently higher proportions occurring during the earlier periods and lower values during the middle part of the last millennium BP. Figure 5.33 shows the ratio of formal tools to edge-damaged pieces in quartz. It is quite clear

that during the early part of the LSA at Elands Bay little emphasis was placed on the manufacture of formal tools since the graph shows the lowest ratios at that time, while for the remainder of the LSA the ratio varies considerably, with edge-damaged pieces being outnumbered by formal tools in many assemblages.

Edge-damaged pieces in quartzite (Figure 5.34), silcrete (Figure 5.35), CCS (Figure 5.36) and FGB rocks (Figure 5.37) are much more sporadic than those in quartz. Only silcrete has enough for the data to be reliable, although it does seem that edge-damaged pieces are generally more common in all four of these materials with formal tools frequently not being present at all. In sandstone and 'other', edge-damaged pieces are far too few and sporadic to produce meaningful data.

5.6 FORMAL TOOLS

For the purposes of the presentation and discussion of these results, formal tools are divided into three sub-categories as follows:

- Scrapers (including scrapers with backing);
- Backed Pieces; and
- Other types (including all non-scrapers or backed forms as well as miscellaneous retouched pieces).

General results for formal tools are presented first, followed by a detailed examination of certain classes of tools.

Overall, formal tools are not particularly common in the Elands Bay Later Stone Age with many assemblages containing fewer than 2%. Figure 5.38 shows the proportion of formal tools. The set of values that includes chips gives a reasonable reflection of what the total

formal tool proportions should be, although with the greater frequency of chips that should probably be present these values would drop even further. One pattern that emerges from these data is the low frequencies of formal tools until 9650 BP and again after 1000 BP, with the intervening period showing somewhat higher values. At Pancho's Kitchen Midden, a number of utilised *P. barbara* shells were recovered, primarily from the upper layers dating to c. 570 BP (Jerardino 1998). The use of non-lithic materials during the final millennium may well have contributed to the scarcity of retouched stone tools during this time.

Quartz consistently accounts for about 70% of the formal tools (Figure 5.39) with quartzite, silcrete and CCS tending to make up the majority of the remainder. While the FGB rocks account for a similar proportion of formal tools to CCS, they are restricted almost entirely to the earlier part of the LSA sequence where they are relatively commonly used. The low frequencies of formal tools encountered during the last thousand years have resulted in the appreciable fluctuations in their raw material proportions.

Although most formal tools are made in quartz, the proportion of formal tools within the quartz assemblage is generally lower than that for any other raw material as shown in Figures 5.41 to 5.43. It is clear that when other raw materials are flaked, they are favoured for the production of formal tools. Of course, some of the values in these figures are excessively high due to the small assemblage sizes in these materials, but it is pertinent that, even with so few artefacts, formal tools are frequently present.

With regard to tool types, backed pieces are by far the least common in the Elands Bay LSA, with scrapers and other types each contributing a large proportion. In Figure 5.44 MRPs, which dominate the other types, are separated from the remaining other tools in order to

demonstrate the high proportion of these artefacts present. It is clear that when they are omitted, scrapers dominate more strongly.

Figure 5.45 shows the proportions of formal tool types within the quartz assemblage. Due to the dominance of quartz among the formal tools this figure is little different to Figure 5.44. Scrapers and MRPs dominate the quartz formal tools with backed tools and the remaining other tools playing a small role. In all other raw materials the other tool types tend to be strongly dominant and of those, most are miscellaneous retouched pieces. Silcrete has a marginally different pattern to the other raw materials with backed tools and scrapers being fairly equally represented (Figure 5.46). CCS and quartzite display almost identical patterns with a minimal number of backed items and a handful of scrapers being present. Silcrete and CCS formal tools occur mainly between the mid-Holocene and about 3000 BP, while those in quartzite and other materials are thinly scattered throughout the LSA. FGB rocks are used for formal tools almost exclusively before about 8500 BP. While 'other' rocks are very seldom used. Interestingly, FGB rocks and 'other' are not used for formal tool manufacture at all after 1000 BP.

Due to the large number of individual formal tool classes present within the current sample, their discussion will be limited to a few specific types, most of which have temporal significance. Steward (1954), in his discussion of artefact types, used the term "historical-index type" to signify chronological rather than morphological or cultural significance (see Section 3.2.3). These artefacts occur at specific times only and can be used to provide an indication of the relative date of the assemblages in which they are found.

Note that the figures illustrating the distributions of these artefacts have been constructed so as to show the proportion of all of that particular artefact type occurring in each assemblage. For example, Figure 5.47 shows that 54.5% of all 'big-D scrapers' in the current sample occur in the 8800 BP EBC assemblage. This format has been chosen to emphasise the temporal distribution of these artefacts and it should be remembered that in each case the total number of tools is always quite small. Due to their sparse representation and/or meaningless distributions through time, no other formal classes are discussed here.

Scrapers

At Elands Bay many different scraper classes exist for the LSA but here only three will be discussed. The first type, the big-D scraper, is restricted to Elands Bay Cave and occurs mostly between 8900 and 8000 BP (Figure 5.47), although three of the twenty-two examples present occur in the 4300 BP assemblage, all in the unit SHAK which overlies the pre-8000 BP material. It is suggested that these are likely to be intrusive (Parkington, pers. comm.), especially since the units in which they occur span the mid-Holocene hiatus. Big-D scrapers are almost always made from quartz with just one each of quartzite and silcrete being present. At this point an interesting comparison with *Donax* scrapers needs to be made. These are scrapers made on the wide end of the shell of the white mussel, *Donax serra*, and with a working edge flaked to almost exactly the same shape as a big-D scraper. Examples of each, along with some other similar-sized stone scrapers are illustrated life-size in Figure 5.48. Unfortunately, at the time of drawing, no shell scrapers from EBC were immediately available, but three specimens from EBC are photographed in Pettigrew (1977, following p. 137).

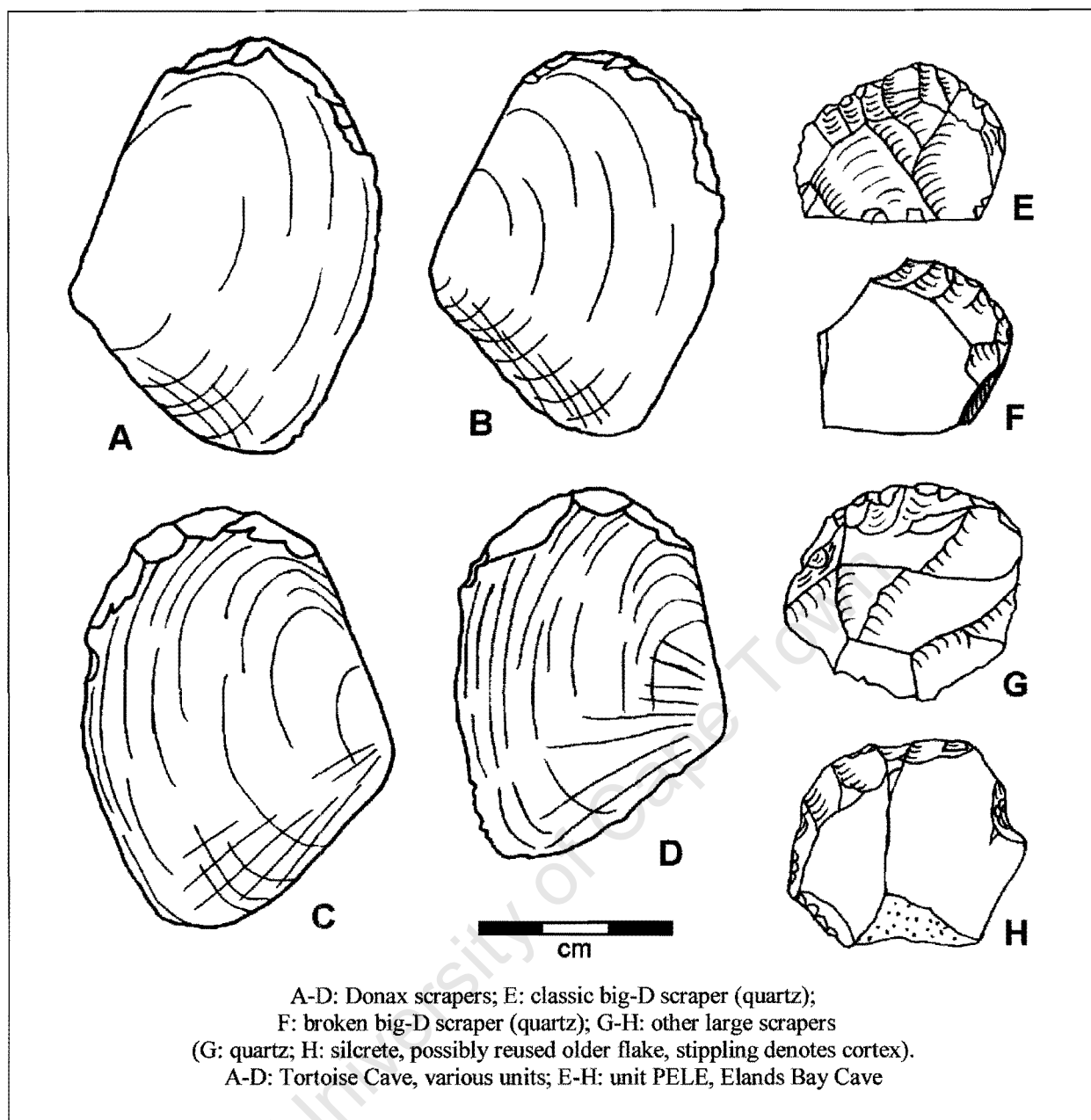


Figure 5.48 Large stone scrapers and *Donax* shell scrapers.

At EBC 83.2% of all *Donax* scrapers come from units falling within my 8800 BP, 8500 BP and 8000 BP assemblages (Parkington Yates, in prep. b). The distributions of these two scraper types are virtually identical. Since big-D scrapers occur at sites in the interior as well, I would suggest that the shell scrapers were made to complement the stone scrapers at this time rather than replace them. Despite the apparent cessation of production of big-D scrapers after 8000 BP, *Donax* scrapers continue to be made, albeit in far smaller quantities. They can

then be regarded as having replaced the stone scrapers. This interpretation unfortunately has no analogues, with no known similar chronological distributions of these artefacts anywhere (Parkington 1990). The only site of similar antiquity in the area, Faraoskop, only contains *Donax* scrapers in its post-mid-Holocene layers. *Donax* fragments were noted throughout the Boomplaas Cave deposits, and only in quantities small enough to suggest non-food use, but no scrapers are reported (J. Deacon 1984b). Unfortunately, worked shell from Nelson Bay Cave has not been studied. Melkhoutboom also contains *Donax* shells, some of which are thought to have been used (H. Deacon 1976), with most being recorded in the mid-Holocene layers.

Backed scrapers, traditionally seen as being indicative of the mid-Holocene or slightly later, have an interesting distribution in that they appear only once at Elands Bay Cave, in the 4300 BP assemblage, with the remainder all occurring at Pancho's Kitchen Midden through three layers of occupation (Figure 5.49). Five of the nine examples occur at 3000 BP and two at 2640 BP in PKM, while only one is found in each of the PKM 3570 BP and EBC 4300 BP assemblages. Parkington and Yates (in prep. a), however, record a few other examples from EBC occurring between 4350 BP and 3550 BP. In the immediate interior of the western Cape backed scrapers are usually made in silcrete (Manhire 1987), but interestingly the coastal Elands Bay sample shows eight in quartz (all at PKM) and one in CCS (EBC).

Thumbnail scrapers have a similar temporal distribution to backed scrapers with most (six) occurring between 4300 and 3400 BP (Figure 5.50). One occurs in PKM at 2640 BP and one in the undated mid-Holocene DFM 1 assemblage while, interestingly, two are found in the EBC 8500 BP assemblage. While these latter may be intrusive from the overlying mid-Holocene layers, it is also possible that they may actually belong to this period (Parkington,

pers. comm.). Thumbnail scrapers are usually found in fine-grained material or quartz and at Elands Bay two are made in silcrete with the remainder being quartz.

Backed Tools

The single backed tool that will be discussed, the segment, is also classically regarded as a mid-Holocene indicator since they are generally most numerous in assemblages dating to between 7000 and 4000 BP (Mitchell 2002b). At Elands Bay segments are more tightly restricted to the mid-Holocene than either the thumbnail or backed scrapers, with six occurring in the undated DFM 1 assemblage, two at EBC at 4300 BP and one at PKM at 3570 BP (Figure 5.51). In the western Cape segments are most frequently made in quartz, especially in the Sandveld, immediately inland of the current research area (Manhire 1987), but in the current sample only two are in quartz, with five in silcrete and one in CCS.

Other Tools

The last of the 'historical-index' types discussed is what Parkington (1984) has termed the "naturally backed knife" (NBK). This artefact is only found in the earlier periods of the LSA and the current Elands Bay Cave sample shows four examples spread between 13 100 and 8500 BP (Figure 5.52). In total, EBC contains nine NBKs, all of which occur within the same time range. Petrographic thin sections have shown that at least some NBKs were made on hornfels (Parkington, pers comm.), a material not found in the area. Since hornfels is certainly not present in any great quantity, and perhaps not even at all among the débitage from Elands Bay Cave, it has been suggested that these pieces were imported ready-made from elsewhere (Parkington 1990).

NBKs have been shown through microwear analyses to have been used in the cutting and working of wood (Parkington & Binneman, n.d.) with the same having been demonstrated for adzes (Binneman 1982; Binneman & Deacon 1986). Although both types occur during the late Pleistocene, the next few millennia show very few adzes. With NBKs generally being most common in the terminal Pleistocene/early Holocene period (Mitchell 2002a; Wadley 1993) it may be that they were effectively a replacement for adzes during a period in which larger artefacts were the norm and were once more replaced by adzes during the Holocene.

Adzes are one of the more common stone tool types at Elands Bay and occur throughout the LSA. However, some patterning is evident in that there is a small concentration of adzes from 13 600 to 10 550 BP and a good scatter between 4300 and 1000 BP, with very few found in the assemblages of the last thousand years (Figure 5.53). Interestingly, only one is found at EBO, with all the rest being at EBC and PKM. Jerardino and Yates (1996) have commented on the prevalence of adzes in the area after 3500 BP, but the data presented here show that they probably occurred commonly from the end of the mid-Holocene hiatus about 4300 years ago.

An unusual and well documented feature of adzes is that some are made on older, well weathered flakes (Anderson 1991; Kaplan 1987; Manhire 1987; Parkington 1998; Rudner & Rudner 1954), presumably collected from MSA scatters (Manhire 1993; Parkington 1998). Although unquantified in the current sample, it was noticed during the analysis that some of the Elands Bay adzes had indeed been made on such flakes. One explanation for this phenomenon is that the technology of the LSA did not allow for the production of the large, rectangular shaped flakes necessary for adze manufacture, and with such pieces available through scavenging there was no need to modify the contemporary technology. Another

suggestion is that these were tools made and used only by women (Parkington 1998). Since women are unlikely to have been active stone knappers, it is thought that scavenged blanks would have to have been obtained to make these tools. The presence of many examples, most notably those in quartz, not made on older flakes challenges both these theories.

Miscellaneous retouched pieces are an interesting and morphologically variable class. They represent all formally retouched pieces that are unidentifiable for one reason or another, and occur throughout the LSA. Figure 5.54 shows the proportion of MRPs among the formal tools in each assemblage. The early part of the LSA, until about 8000 BP, consistently contains the most MRPs. Thereafter, they become relatively fewer and more sporadic. The values for the last millennium assemblages are somewhat distorted due to the fact that fewer formal tools were made during this time. Figure 5.55 presents the MRP data as a frequency of the total assemblage. From a comparison of this figure with Figure 5.38, it is apparent that MRPs constitute a good proportion of all formal tools, and as such, to some degree their frequency reflects the overall incidence of retouch.

5.7 SUMMARY: THE ELANDS BAY LITHIC INDUSTRIES

In this section, as before, the overall raw material proportions quoted include chips, while all other figures, unless otherwise stated, are calculated with chips excluded in order to maximise comparability.

The Later Stone Age at Elands Bay essentially has its first clear manifestation in Elands Bay Cave around 13 600 BP. The underlying assemblages, characterised primarily by large, irregular quartz chunks and dating to about 20 000 BP, represent either a transition to the LSA (Parkington 1990) or, more likely, an early LSA (Parkington, pers. comm.). At 13 600

BP a microlithic quartz-rich industry was manufactured at EBC. Owing to the amount of variation included in such industries across Southern Africa, the terms 'Robberg' and 'Robberg-like' have both been used to describe them (Mitchell 2002a; Wadley 1993, 1997). The latter is more applicable to the EBC assemblage since the lower blade proportions (10.87% of all flakes and 10.15% for quartz flakes alone) and blade : core ratio (1.05 in total and 0.84 for quartz alone) suggest an industry not as dominated by bladelet manufacture as some of those recorded elsewhere (e.g. J. Deacon 1978, 1984b; Mitchell 1988a; Wadley 1993). Unlike many other sites, bladelet cores of any sort are not obvious in this assemblage. Bipolar cores comprise 82% of all quartz cores, and an interesting relationship between them and other core types will be explored in later chapters. At this time quartz is strongly dominant, accounting for more than 86% of all artefacts with quartzite contributing 7.9% and all other materials 5.8%.

Immediately after this, at 13 100 BP, there is a change in the lithic industry. The proportion of blades and bladelets among the flakes drops to 4.3%, although in quartz they continue to comprise some 5 to 6% of flakes until 10 550 BP, suggesting some technological continuity in the use of this raw material. In addition, at 13 100 BP, the ratio of blades to cores drops considerably (0.49 in total and 0.31 in quartz alone), quartz now comprises only 81% of the raw materials and perhaps most significantly there is a reduction in the use of quartzite accompanied by a substantial increase in the use of all other materials. Quartzite accounts for just 3.3% with the remaining materials now contributing 15.7%. While elements of the late Pleistocene industry continue to be seen until 10 550 BP, the frequency of chips in the quartz assemblage (Figure 5.56) indicates either a shift in the mode of production, which is not suggested by the core ratios, or an increase in the skill of the stoneworkers, such that less wastage in the form of unusable chips occurs. Although issues with the reliability of chip

frequencies exist at Elands Bay Cave, the excavator assumes the problem to be fairly uniform (Parkington, pers. comm.), thus allowing comparisons of relative frequency to be meaningful. The significant drops after 13 600 BP and 11 370 BP are clearly visible in Figure 5.56.

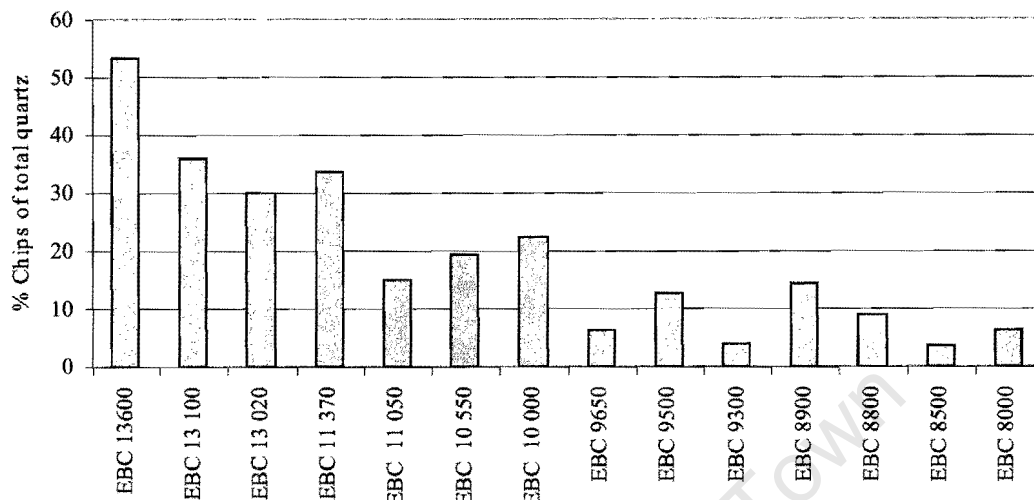


Figure 5.56 Frequency of quartz chips in the terminal Pleistocene and early Holocene assemblages from Elands Bay Cave.

This industrial change at 13 100 BP suggests a significant shift in people's attitudes to lithic raw materials and begins the uniform decline in the use of quartz which culminates at 10 000 BP when it comprises only 54.5% of the assemblage. This period, during which such high proportions of non-quartz materials were used, continued until 8900 BP although an approximately 15% increase in the use of quartz is evident in the 9500 and 9300 BP assemblages. Interestingly, it is also at 9500 BP that the proportion of formal tools within the quartz assemblage makes its first significant increase. A particular trend evident during this period is the use of FGB rocks. Between 13 020 and 8900 BP these rocks consistently contribute some 3 to 5% of the raw materials. While these figures do not sound particularly

impressive, it should be borne in mind that these rocks occur very infrequently after 8000 BP, seldom accounting for more than 1% of the total assemblages.

At 8800 BP further distinct changes take place in the lithic assemblages, the most significant of which is the reversion to extremely high quartz proportions (between 87 and 89% - the highest values attained in EBC) accompanied by drops in the use of all other materials. While edge-damaged pieces show a steady decline in numbers beginning at 9500 BP and continuing through to 8000 BP, the overall proportion of formal tools more than doubles from 1.2% at 8900 BP to 2.9% at 8800 BP. Among the formal tools, scrapers now comprise the majority for the first time while MRPs are far fewer than either before or after this time. Although a single D-shaped scraper exists in the 8900 BP assemblage, these artefacts make their proper arrival at 8800 BP with 11 being present. Thumbnail scrapers are not present at 8800 BP, but first occur at 8500 BP, coincident with the final appearance of naturally backed knives. Among all formal tools, MRPs are suddenly far less common in relation to the other types. Interestingly, despite the other changes taking place at this time, there is almost no change in the proportion of the different types of quartz cores present.

The 8000 BP assemblage represents the final early Holocene occupation of Elands Bay Cave before the hiatus that lasted for some 3600 years. At this time quartz again decreases, while quartzite, silcrete and sandstone are used more frequently. The composition of quartz cores undergoes a change with single platform cores increasing substantially at the expense of irregular cores. Interestingly, this pattern is more similar to what occurs at 4300 and 4160 BP than to the preceding assemblages and it seems likely that this assemblage represents either the final transition to, or the first real occurrence of Wilton technology in Elands Bay. Also within the quartz assemblage, the ratio of flakes to chunks decreases dramatically with

chunks outnumbering flakes for the first time, while quartz blades and bladelets are entirely absent. Formal tool proportions, however, are not much different from before. Unfortunately, with no further continuous occupation, it is uncertain whether the changes noted at 8000 BP are real or a function of sampling or small assemblage size.

With the DFM 1 rounded assemblage assumed to be mid-Holocene in age, it constitutes the only assemblage between 8000 BP and 4300 BP, and is, therefore, rather difficult to relate to the other assemblages. However, a few comments will be made. It should be noted that the wind or water abrasion of the artefacts in this assemblage has resulted in the over-representation of chunks and the existence of some anomalous values in the typological analysis. While the proportions of quartz and silcrete are high, those for other materials are fairly low with FGB rocks and 'other' being barely represented at all. During the analysis it was noted that almost all the quartz was milky and that many of the quartz flakes exhibited clear bulbs of percussion, something not normally noted on quartz. These factors, along with the low incidence of bipolar cores and high incidence of single platform cores suggest that large, good quality blocks of vein quartz were actively sought out. While the unusually high ratio of quartz blades to cores is undoubtedly due to the under-representation of cores, the real value is likely to be fairly high, perhaps something of the order of the 0.38 shown by the 4300 BP assemblage from EBC. Perhaps the most interesting feature of this assemblage is the high proportion of silcrete among the formal tools. While quartz may be slightly under-represented, this does still surely indicate a different agenda in the manufacture of formal tools. Backed tools, specifically segments and drills and borers dominate this assemblage. With mid-Holocene assemblages frequently containing a wide array of backed elements (H. Deacon & J. Deacon 1999), this formal tool composition lends further support to the suggestion of a mid-Holocene date for the assemblage.

Interpretation of patterns during the last 3500 years becomes increasingly difficult as the introduction of assemblages from other sites causes a far greater degree of variability among the data. Probably the main reason for this is the difference between long- and short-term occupations as identified by Parkington (1993). Major occupations represent an average of the events taking place at a site over a long period while open, more ephemeral sites will have resulted from short-term occupations with their lithics reflecting specific events. As such the former will produce rather “average” data, and the latter more “extreme” values. Interestingly, when assemblages are compared with others from the same site, they tend to show a greater degree of similarity in both raw materials and artefact types than is evident between contemporaneous assemblages from different sites, something already noted by Parkington (1980b) for EBC.

Nevertheless, some patterning is noticeable during this period, and despite the difficulty in drawing separations between groups of assemblages, I attempt to highlight some of these patterns. Some are of a more general nature and must be examined across the entire spectrum of assemblages, while others are short-term trends which may help to tease apart finer technological groupings. The general patterns will be examined first.

Quartz proportions are generally high with values between 80% and 90% being the norm. A curious feature of the post mid-Holocene assemblages is that those from sites located further away from the seashore tend to have more quartz, with most values ranging between 89.2% and 98.3%. At two points this pattern breaks down. The first is about 3000 years ago when the assemblages from PKM (3000 BP) and SC (2970 BP), both relatively inland sites, show proportions of 83.3% and 72.9% respectively, while EBO (2920 BP) has a high value. This may not be a real pattern since the trend is short-lived, but it is suggestive since the three

assemblages are temporally related and coincide roughly with the start of the megamidden period. The second occurs during the last few centuries of occupation when SC has a very low value. Unfortunately, both SC assemblages are very small and the pattern may, therefore, be a result of sampling bias. The successive occurrence of quartz proportions of less than 80% in all three of the most recent assemblages, however, does suggest that this particular reduction in quartz may, at least locally, be real, and unrelated to distance from the coast. This is discussed further in Chapter 7. A further pattern in quartz proportions is reflected by the fact that the seven assemblages with the highest values are all from open or semi-open sites (there are thirteen such assemblages in total). This may be due to quartz being the most easily available material, such that it was preferentially used when short occupations were planned.

Beginning at 8000 BP and continuing throughout the occupation of the site, higher proportions of silcrete are consistently used at EBC than at other sites. Interestingly, no other assemblage has a silcrete proportion as high as the lowest attained in EBC and the only other cave site, Spring Cave, shows quite low values. Although the early mid-Holocene is poorly represented, it is tempting to suggest that from 8000 to about 3900 BP there was a more consistent interest in silcrete than at any other time. This conclusion is supported by the data from Tortoise Cave (Robey 1987, Table 3).

That FGB rocks occur only in EBC and DFM 1 has already been noted (Section 5.2.3 above), and it would seem that there must have been a source close to EBC or the people were obtaining FGB rock pebbles from far away. EBC also shows the greatest use of 'other' raw materials throughout its occupation.

The widely varying proportions of flakes and chunks within the quartz assemblages reflect the variation in flaking techniques used, as witnessed by the changing proportions of quartz core types. Interestingly, while bipolar cores come to dominate after 1000 BP, the proportions of quartz flakes and chunks continue to be extremely variable. It is perhaps pertinent that EBO and BPM, both located immediately in front of EBC, always show higher proportions of chunks. Maybe this reflects a difference in activities carried out between the cave and open situations?

Now I turn to those finer details which may help isolate any short-term trends within the last 4300 years. These are mostly limited to the latter part of this period, with the late mid-Holocene assemblages being a somewhat amorphous mass with a great deal of minor variation and few strongly unifying trends. For these reasons I shall proceed in more general terms rather than comparing figures as I did for the pre mid-Holocene assemblages.

There is an apparent tendency towards slightly higher proportions of formal tools extending from 4300 BP until 2640 BP. In addition, a decrease in the ratio of miscellaneous retouched pieces relative to scrapers and backed tools is also evident. These patterns are expected since the mid-Holocene period is widely acknowledged to contain a far greater variety and number of formal tools than any other period during the LSA (J. Deacon 1984b; H. Deacon & J. Deacon 1999; Mitchell 2002b). Although little other evidence for artefact change exists in the current sample, the post 2640 BP reduction in formal tools is interesting in that it does coincide with the general trend noted by Robertshaw (1979).

Other than the 4300 and 2190 BP assemblages from EBC, there is a tendency towards low proportions of bladelets in those assemblages where they are made. This is in keeping with

the findings of J. Deacon (1984b), who noted a decrease in the mean length of mid-Holocene flakes in the southern Cape when compared with the earlier periods of the LSA.

While the high quartz proportion remains relatively stable, there is a period between 2920 and 1550 BP when quartzite is particularly uncommon. This is evident in both the overall proportion of quartzite and the low quartzite core frequency.

Sheep and pottery are widely accepted to have been introduced to the south-western Cape some 2000 years ago (Sadr 1998), although the question of whether they were introduced as a result of the diffusion of their use or by their having been physically brought to the Cape by a migrating people remains open to debate (Sadr 2003). Either way, the introduction of these commodities represents a considerable economic change. It is thought that pottery dates slightly earlier than sheep (Sealy & Yates 1994), although evidence from Blombos Cave in the southern Cape suggests that this may not be the case (Henshilwood 1996). Associated with, or perhaps beginning slightly before, these significant introductions, we frequently see changes in the stone artefact assemblages and reductions in the density of lithics (e.g. Robey 1987; J. Deacon 1972; H. Deacon 1976; Jerardino 1996). As discussed in Chapter 2, it is possible that such changes in tool manufacturing traditions may well have begun to take place from at least 2500 years ago. Prior to any other sites having been explored at Elands Bay, Robertshaw (1979) stated that EBC was an exception to this trend, with few formal tools occurring during the Holocene and no evidence for changes in artefact manufacture. The current research suggests that this pattern does not exist in any Elands Bay sites.

At Elands Bay neither pottery nor sheep bones are evident as early as 2000 BP. DFM 11 has no sheep bones (Dewar, pers. comm.), but contains the earliest known occurrence of pottery

in Elands Bay at 1780 BP. Sheep are thought to have been introduced to the area between about 1800 and 1600 years ago (Parkington *et al.* 1986) and the earliest dated examples occur with pottery at Tortoise Cave at about 1650 BP (Robey 1987). The earliest incidence of both sheep (Klein & Cruz-Urbe, in prep.) and pottery (Parkington & Yates, in prep. b) at EBC is at 1550 BP, while EBO contains sheep bones from 1470 BP (Klein, pers. comm.). Despite their relative prominence at Diepkloof some 15 km upstream from about 1590 BP onwards (Parkington & Poggenpoel 1987), sheep bones never occur in any great number at any site in or near the Elands Bay area. Although Robey (1987) demonstrates a dramatic decrease in the frequencies of formal tools coincident with the introduction of stock at Tortoise Cave, there are no significant lithic changes at EBC until about 1000 BP. Based on the lithic evidence, the initial introduction of pottery and sheep are unlikely to have had a significant influence on the economy of the people living in the Elands Bay area.

Immediately after 1000 BP the first real change in technology for 7000 years is evident. The first thing to be noticed is that assemblages are almost always small. Although this may be largely a result of excavational bias, support for this fact is present in the observation that a higher proportion of sites from this time are very small, presumably only reflecting short, infrequent visits (Manhire *et al.* 1984). DFM 1, which covers an unusually large area, is the only definite exception in the current sample. HSM also covers a large area, although the site is scattered over the crest of a large dune such that some of the spatial extent may be due to material sliding down the dune faces. From 950 BP until 570 BP quartz averages slightly higher proportions than during the preceding 500 years while quartzite becomes far more variable. With the exception of EBC, all assemblages from this time show reduced proportions of all other materials. Interestingly, despite the variation in quartzite and the lack of fine-grained rocks used, the ratio of quartzite to sandstone is consistently low, suggesting a

greater concern with the quality of stone used but a lack of desire to travel in search of better materials than those that were locally available. Exactly coincidental with this pattern is the first incidence since the late Pleistocene of bipolar cores consistently dominating the quartz cores, suggesting that bipolar flaking was recognised during both periods as being the optimal way of maximising the flake yield from small quartz nodules.

Only in some post-950 BP assemblages are bladelets manufactured. In most instances where this occurs the bladelets invariably comprise a relatively high proportion of the total number of quartz flakes, suggesting that bladelet manufacture may have been intentional. The low blade : core ratios, however, are significantly lower than 1, and, following Barham's (1989b) suggestion, would still suggest bladelet manufacture to be incidental. Of course, it is quite possible that a significantly lower ratio should apply to such quartz-rich assemblages as we see around Verlorenvlei, since Barham's Swaziland sites contain, on average, only some 20% quartz. Although possibly dubious in their origin, it is noticeable that few quartz edge-damaged pieces occur in post-1000 BP assemblages. The 880 BP assemblage from PKM does not comply with this pattern, but this may be due to its being one of the smaller assemblages. Other raw materials show high proportions of edge-damaged pieces, but total artefact counts in them are all extremely low.

Scrapers normally dominate formal tool assemblages, but between 950 BP and 570 BP they are seldom produced in any numbers and adzes are even scarcer. Unfortunately, the numbers of formal tools are too low to make much comment on the raw materials used, but the lack of tools made on FGB rocks or 'other' during the final millennium BP is noticeable.

A second break in the artefact-making tradition is evident within the last 1000 years with the final three assemblages representing something far less formal. While quartz use is once more reduced, the cumulative total of all other materials increases significantly. Interestingly, this increase is not attributable to one particular raw material across all three assemblages, making interpretation difficult. At 550 BP at EBC silcrete is the main contributor, at 460 BP at SC it is sandstone, while the final EBC assemblage from 320 BP shows increases in silcrete, sandstone, FGB rocks and 'other' when compared to the earlier late Holocene assemblages. Perhaps the most marked change evident at this time is the drastic reduction in bipolar cores in favour of the irregular variety. Both the cores and raw material data emphasise the lack of uniformity among these very late assemblages. Edge-damaged pieces now occur only in quartz, while the formal tool situation remains largely unchanged, although small sample sizes preclude reasonable comparison of the latter.

Table 5.2 provides a summary of the above discussion showing what is probably the best way to divide up the available assemblages into 'technological traditions'. Perhaps largely a symptom of past research norms, many other researchers have placed all assemblages into one of the three major LSA industrial groupings, even when transitional tendencies are clearly exhibited (e.g. J. Deacon 1978). In contrast, I have chosen to place some assemblages into separate groupings which are clearly transitional between the major industries occurring before and after them. This has been necessary in the light of the fact that the Elands Bay lithics appear to represent a more-or-less continuous sequence of technological evolution. This contrasts starkly with the model of "homeostatic plateaux" proposed by H. Deacon (1976, Fig. 43) for the southern Cape, in which the three major artefact making traditions of the Later Stone Age are seen as periods of relative stability separated by short periods of rapid change. Parkington (1980) pointed out some of the shortcomings of this model, and

although no longer in favour, it will be contrasted in Chapter 8 with an alternative model suggested by the current research. The conclusions reached here support the detailed work by Parkington and Yates (in prep. a) who suggest that the EBC lithics demonstrate a process of gradual change. It should be stressed that some of the characteristics mentioned in Table 5.2 may be the result of site-specific variation rather than general technological change.

Table 5.2 General characteristics of the LSA artefact making traditions of Elands Bay.

Dates*	Character	Quartz**#	Other raw materials***†	Formal tools††
13 600 BP	Late Pleistocene microlithic (Robberg-like)	Dominant (85%). Bipolar cores 80%. Blades 10%.	Quartzite rare (~8%). Other materials rare (~6%).	Few formal tools, <0.5%. Mostly made in quartz (90%). Scrapers 10%; backed 30%; MRPs >50%.
13 100 – 11 370 BP	Late Pleistocene microlithic	Dominant, declining with time (80-75%). Bipolar cores 55-75%. Blades 3-7%.	Quartzite rare, increasing with time (3-7%). Other materials common (>15%).	Few formal tools, <1%. Quartz variable (40-70%). Scrapers ~10%; backed ~10%; MRPs >50%. NBKs appear.
11 050 – 10 550 BP	Transitional	Common, declining with time (70-60%). Bipolar cores (60-90%). Blades 5-7%.	Quartzite common, increasing with time (10-15%). Other materials common (20-25%).	Few formal tools, <0.5%. Mostly made in quartz (80%). Scrapers ~20%; backed absent; MRPs >50%. NBKs present.
10 000 – 8900 BP	Terminal Pleistocene / Early Holocene nonmicrolithic (Oakhurst-like)	Moderate, increasing with time (55-70%). Bipolar cores 55-65%, but with exceptions; irregulars 20-30%. Blades variable (1-4%).	Quartzite common, but variable (10-25%). Other materials common, but variable (15-25%).	Few formal tools, 1%. Quartz variable (50-90%). Scrapers 20-50%; backed rare; MRPs >50%. NBKs present.
8750 – 8500 BP	Transitional	Dominant (85-90%). Bipolar cores 50-60%, irregulars 35-40%. Blades 1-1.5%.	Quartzite rare (<5%). Other materials rare (7-8%).	Many formal tools, 2-3%. Mostly quartz (80%). Scrapers >60%; backed rare; MRPs <30%. Last appearance of NBKs. D-shaped scrapers common. First appearance of thumbnail scrapers.
8000 BP	Holocene microlithic (possibly transitional)	Common (75%). Bipolar cores ~60%; single platforms ~25%. Blades absent.	Quartzite rare (~7%). Other materials common (~15%).	Many formal tools, >3%. Quartz low (50%). Scrapers ~50%; backed absent; MRPs ~50%.

Dates*	Character	Quartz***	Other raw materials**†	Formal tools††
4300 – 1000 BP	Holocene microlithic (Wilton-like)	Dominant (80-90%). All cores very variable: bipolar cores 40-70%; single platforms 20-30%; irregulars 20-40%, but all with exceptions. Blades very variable (1-3%, but with exceptions both sides).	Quartzite rare (3-6%), but with exceptions both sides. Other materials very variable (5-15%).	Formal tools variable, generally 1-2.5%, but with exceptions. Quartz variable (usually 60-80%, but with exceptions). Composition variable: scrapers usually 50-60% but 30% c.1.5-1k BP; backed 10-30% or absent; MRPs 10-70%.
950 – 570 BP	Late Holocene assemblages with pottery	Dominant (80-95%). All cores very variable: bipolar cores 70-100%; single platform 0-30%; irregulars 0-30%. Blades very variable, (3-7%, or absent).	Quartzite variable (2-15%). Other materials rare, (1-5%) but with exceptions.	Few formal tools, 0.5-1%, but with exceptions. Quartz 70-100% or absent Composition very variable: scrapers rare; adzes rare.
550 – 320 BP	Late Holocene assemblages with pottery	Common (70-80%). Bipolar cores 50%; single platforms 15-20%; irregulars 35-50%. Blades very variable, (4-8%, or absent).	Quartzite common (8-12%). Other materials common (10-15%).	Few formal tools, 0.5-1%. Quartz 50-100%. Composition very variable: scrapers rare; few MRPs; adzes absent.

* The DFM 1 mid-Holocene assemblage is not considered here due to a general absence of similar assemblages in the research area.

** Raw material % of total assemblage (including chips), Core % of total cores, Blade/lets % of total flakes.

Blades = blades and bladelets.

† Cores and bladelets are not considered due to small assemblage sizes in non-quartz materials.

†† % of total assemblage then % total of formal tools.

5.8 DISCUSSION: RAW MATERIAL AND ARTEFACT CHANGE

The lithic assemblages of Elands Bay display no clear breaks or sudden changes through the sequence, but can rather be seen more as a developing and constantly changing continuum with particular trends or features being more typical of certain periods than others. As such, I tend to agree with the early sentiments of J. Deacon (1978) that in some ways it is inadvisable to separate stone artefact assemblages into culture-stratigraphic groupings since there is clearly some continuation displayed between groupings. Later, she comments that these groupings are merely a means of characterising the major changes through the LSA (J. Deacon, 1984b), but I still see the implementation of these changes, at least at Elands Bay, as being too gradual to allow even such coarse categorisation. At EBC there is a continuum of

occupation spanning the Late Pleistocene microlithic and terminal Pleistocene/early Holocene nonmicrolithic periods and it is quite clear that the group of intervening assemblages displays characteristics of both traditions. As such, I am not prepared to force any of these assemblages into either grouping, but prefer to describe them as transitional. Parkington and Yates (in prep. a) also identify transitional characteristics in assemblages dating to just before 10 800 BP.

Unfortunately, with the exception of one assemblage which lacks an absolute date, there is a substantial mid-Holocene occupational hiatus immediately following the generally accepted 8000 BP date for the onset of the Holocene microlithic tradition. This precludes a comprehensive study of the onset of this tradition in the area, although the 8000 BP EBC assemblage does appear to show characteristics typical of the Holocene microlithic, probably suggesting that this tradition was already underway in the area at that time. The two preceding assemblages, however, are clearly transitional with elements of both the nonmicrolithic and microlithic traditions present. During the late Holocene no clear lithic changes into the ceramic period are evident with the greatest degree of change occurring well after the introduction of pottery to the area.

Raw material change at Elands Bay is perhaps slightly more gradual than artefact change. Although it dominates all assemblages numerically, I suspect that it is not quartz specifically that governs the overall raw material frequencies at Elands Bay. Quartz is ever-present, while other materials are used in variable proportions with quartzite the most frequent. It is the gradual but dramatic increase and subsequent decrease in the use of materials other than quartz between c. 11 050 and c. 8900 BP that seems to be the factor driving the overall raw material proportions. Quartz is generally available in smaller pieces than most other rocks

and is not well suited to the manufacture of larger artefacts. During the late Pleistocene and early Holocene the desire to manufacture larger artefacts would have led people to select materials that were available to them in larger nodules or blocks. Quartzite and sandstone are particularly prominent at this time since they are the materials most easily available in larger forms. 'Other' is comprised largely of course-grained igneous rocks and together with quartzite and sandstone indicate a general lack of concern over the raw material quality for certain artefacts at that time. Quartz was still the favoured raw material and the overall raw material distribution at this time is certainly related to the desire to conserve this relatively high quality stone. The continuous but numerically insignificant presence of silcrete and cryptocrystalline silica presumably indicates a continual desire for these materials, but with their limited availability precluding their frequent use. Silcrete, perhaps the most common fine-grained material in the Western Cape, does, however, show a markedly greater degree of use in the post-8000 BP assemblages, which is surely a reflection of the greater desire for fine-grained materials during the Holocene microlithic period.

Formal tools also show patterns of change relating broadly to the three major artefact making traditions but showing a degree of overlap between them. 'Historical-index' tool types, with their restricted temporal distributions, are useful in indicating either when artefact change took place or when short periods of relative stability in artefact-making existed. At Elands Bay, three of these tool types illustrate points at which change came about on either side of the Pleistocene/Holocene transition, while the remaining two indicate some degree of relative stability through the mid-Holocene.

It is interesting to note that, at sites in the southern Cape, big-D scrapers occur more frequently in the pre-10 000 BP levels (J. Deacon 1984b), while at EBC they are an

exclusively post-9000 BP form, occurring in the transitional assemblages of that time. The southern Cape scrapers tend to be larger, however, and also more variable in size than those from EBC. A few thumbnail scrapers, which are normally associated with Holocene microlithic assemblages (J. Deacon 1984b), also occur in these levels at EBC. Naturally backed knives show the greatest temporal distribution with examples first occurring in the late Pleistocene microlithic assemblages and continuing right through until the transitional period leading into the Holocene microlithic period. Segments and backed scrapers, on the other hand, are confined to the mid-Holocene, indicating relative stability through the middle of the Holocene microlithic period.

I now return to the issue of the Package 4c units from Elands Bay Cave. As discussed in Section 4.3.4, these units include dates of 1790 and 2100 BP (Parkington, in prep., Table 2.2), but based on content are thought to be only about 700 years old (Parkington, pers. comm.). Here I consider their position in the sequence from the point of view of their lithics.

The high degree of general variation observed in late Holocene assemblages, especially those dating after 1000 BP, provides little opportunity for suitable comparison with the relevant assemblages to be made. When viewed alongside the other EBC assemblages in the sample, these units could, in general, quite easily fit into either time slot. Assemblages from other sites within the last thousand years, however, compare less favourably, but this is probably due more to differences in activities carried out on these sites than to technological factors. As a result, little conclusive evidence exists. Two points are, however, worth mentioning. Firstly, the proportion of silcrete in this assemblage is far higher than in any other early to mid-final millennium assemblages, but this is probably due solely to the fact that in EBC silcrete was always slightly more often used (Figure 5.6). Secondly, the formal tools do seem

to display late features with the low overall proportion of tools and their type distribution, especially the lack of adzes and high proportion of MRPs, being the most notable. Based on the latter point, I would tentatively suggest that the lithics support Parkington's interpretation. For the sake of the continuing analyses contained in Chapter 6, this interpretation is assumed to be correct.

6 THE CONUNDRUM EXPLORED

6.1 INTRODUCTION

This chapter considers the three critical periods outlined in Chapter 1. These include the late Holocene, the terminal Pleistocene/early Holocene and the late Pleistocene. The relationships between raw material usage, flaking technique, and artefact types are tracked in an attempt to gauge the role of quartz at these different times through the LSA at Elands Bay. Furthermore, the nine late Holocene assemblages are compared with the four from the late Pleistocene, such that similarities between the two microlithic, quartz-rich occurrences can be highlighted. While Chapter 5 presented a conventional lithic analysis, this chapter employs more detailed methods in an attempt to gain some understanding of the lines of reasoning employed by the manufacturers of the assemblages. It is hoped that some of the factors driving raw material selection and use will be highlighted.

In keeping with the overall aims of the research, I focus primarily on quartz as a raw material and bipolar flaking as a reduction technique. The figures presented are geared towards an understanding of these two factors within the context of each period. Owing to the chip recovery problems discussed in Section 3.1.4, and the detail with which raw material and technology are now examined, all figures in this chapter are based on the total assemblages excluding chips.

Different variables are compared and graphed, either as ratios on bar graphs, or as points on scatter plots. In the event of the latter, a sample correlation coefficient (r), which provides a measure of the strength of the relationship between the two sets of values in the sample, and a test statistic (T), which tests whether the true correlation coefficient is likely to be non-zero, have been calculated for each data set. The data are assumed to follow normal distributions

and a two-tailed T-test was therefore used in the calculation of the test statistic. Conclusions to the T-tests are drawn at the 5%, 10% and 20% levels of significance, although in practice, only the latter one or two can be used to inform the interpretations, on the basis that natural levels of variability within the assemblages, as well as sources of bias introduced by archaeologists, would make it meaningless to seriously consider any higher significance level. The formula used in the t-tests is as follows:

$$T = r \cdot \sqrt{(n - 2) / (1 - r^2)}$$

Table 6.1 Critical values used in determining t-test conclusions.

Degrees of freedom (df)	20% critical value	10% critical value	5% critical value
2	± 1.886	± 2.920	± 4.303
3	± 1.638	± 2.353	± 3.182
4	± 1.533	± 2.132	± 2.776
5	± 1.476	± 2.015	± 2.571
6	± 1.440	± 1.943	± 2.447
7	± 1.415	± 1.895	± 2.365

Source: Shennan (1990, Table C)

Critical values of t are given in Table 6.1. The statistics for each period are presented in tables at the start of each section below, and should be referred to during subsequent discussion of the assemblages. Caution should be expressed when attempting to interpret any correlation coefficients based on small sets of data points, such as those used here. The current sets involve between four and nine points, and for the most part do not provide enough information to guarantee that the correlations are not fluke. Based on a background knowledge of local archaeology, however, some intuitive decisions can also be made on how to interpret the correlations. It is interesting to note that frequently, when significance is

obtained, it often applies right up to the 5% level, suggesting that those few correlations are perhaps likely to be genuine.

6.2 LATE HOLOCENE QUARTZ-RICH ASSEMBLAGES

6.2.1 Introduction

This section considers those nine assemblages falling into the first group of late Holocene assemblages identified in Table 5.2, between 950 and 570 BP.

After 1000 BP, a considerable change in the assemblages is discernible. Quartz (Figure 5.3) and quartzite (Figure 5.4) frequencies increase, accompanied by a general decrease in all other materials (Figure 5.5). The bipolar technique is the strongly favoured mode of reduction (Figure 5.13) and bladelets, when present, tend to be more numerous than before (Figure 5.26). Scrapers are either absent, or form a much smaller component of the formal tool assemblage, with backed tools and miscellaneous retouched pieces making a stronger showing (Figure 5.39). At 550 BP, with the onset of the final grouping in Table 5.2, this trend is reversed with scrapers dominating and the assemblages becoming far more informal.

Between 950 and 570 BP a high degree of variability is displayed among the Elands Bay lithic assemblages. Although most of this is undoubtedly a result of the often small assemblages, factors such as variations in site location and raw material catchment, and the differing activities carried out on the sites, are sure to have had some effect as well. Despite the considerable variability among these assemblages, certain artefact categories or classes can be shown to correlate with the high quartz proportions. The spurious values for the smaller assemblages evident in many of the graphs probably result purely from their small size, and, as such, can most likely be ascribed to sampling bias (see section 3.1.4).

6.2.2 The data

In each figure in this section, those assemblages likely to provide reliable data are indicated by black diamonds or bars, while the hollow diamonds or bars represent those assemblages where the total number of artefacts excluding chips is less than 150. In general these assemblages have fewer than 100 quartz artefacts, excluding chips, and it is these smaller assemblages that are deemed to be the most likely to produce spurious results. These potentially unreliable assemblages are: HSM (950 BP), PKM (880 BP), EBO (705 BP) and PKM (570 BP). On the scatter plots the sites are numbered as follows:

1: HSM (950 BP)	4: EBO (705 BP)	7: BPM (640 BP)
2: PKM (880 BP)	5: EBC (700 BP)	8: EBO (590 BP)
3: SC (840 BP)	6: DFM 1 (650 BP)	9: PKM (570 BP)

Correlation coefficients and t-test results based on both the five reliable assemblages, as well as for the total sample of nine, are given in Table 6.2.

Table 6.2 Sample correlation coefficients and t-test results for the late Holocene assemblages (950 – 570 BP).

Data set*	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion**		
					20%	10%	5%
Quartz vs. bipolar cores (9 points)	6.2	0.386	1.106	7			
Quartz vs. bipolar cores (5 points)		0.893	3.432	3	S	S	S
Quartz vs. non-bipolar cores (9 points)	-	-0.214	-0.579	7			
Quartz vs. non-bipolar cores (5 points)		-0.442	-0.853	3			
Quartz vs. blades (9 points)	-	0.307	0.855	7			
Quartz vs. blades (5 points)		0.683	1.619	3			
Quartz vs. flakes (9 points)	6.3	0.482	1.457	7	S		
Quartz vs. flakes (5 points)		-0.065	-0.113	3			

Data set*	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion**		
					20%	10%	5%
Quartz vs. chunk (9 points)	6.4	-0.612	-2.049	7	S	S	
Quartz vs. chunk (5 points)		-0.398	-0.751	3			
Quartz vs. edge-damaged (9 points)	6.5	-0.093	-0.247	7			
Quartz vs. edge-damaged (5 points)		-0.613	-1.344	3			
Quartz vs. edge-damaged made in quartz (9 points)	6.6	0.840	4.095	7	S	S	S
Quartz vs. edge-damaged made in quartz (5 points)		0.909	3.768	3	S	S	S
Quartz vs. formal tools (9 points)	6.7	0.576	1.862	7	S		
Quartz vs. formal tools (5 points)		0.903	3.651	3	S	S	S
Quartz vs. formal tools made in quartz (9 points)	6.8	0.353	1.000	7			
Quartz vs. formal tools made in quartz (5 points)		0.754	1.988	3	S		
Bipolar cores vs. blades (9 points)	6.10	0.743	2.939	7	S	S	S
Bipolar cores vs. blades (5 points)		0.420	0.802	3			
Non-bipolar cores vs. blades (9 points)	-	0.249	0.681	7			
Non-bipolar cores vs. blades (5 points)		0.123	0.215	3			
Bipolar cores vs. flakes (9 points)	6.11	0.400	1.154	7			
Bipolar cores vs. flakes (5 points)		0.052	0.090	3			
Non-bipolar cores vs. flakes (9 points)	-	-0.204	-0.552	7			
Non-bipolar cores vs. flakes (5 points)		-0.157	-0.276	3			
Bipolar cores vs. chunks (9 points)	6.12	-0.722	-2.764	7	S	S	S
Bipolar cores vs. chunks (5 points)		-0.496	-0.990	3			
Non-bipolar cores vs. chunks (9 points)	-	0.111	0.295	7			
Non-bipolar cores vs. chunks (5 points)		0.415	0.790	3			
Bipolar cores vs. edge- damaged (9 points)	6.13	-0.556	-1.770	7	S		
Bipolar cores vs. edge- damaged (5 points)		-0.306	-0.557	3			

Data set*	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion**		
					20%	10%	5%
Non-bipolar cores vs. edge-damaged (9 points)		0.132	0.354	7			
Non-bipolar cores vs. edge-damaged (5 points)		-0.181	-0.318	3			
Bipolar cores vs. formal tools (9 points)		0.131	0.350	7			
Bipolar cores vs. formal tools (5 points)	6.14	0.914	3.918	3	S	S	S
Non-bipolar cores vs. formal tools (9 points)		-0.670	-2.387	7	S	S	S
Non-bipolar cores vs. formal tools (5 points)	6.15	-0.597	-1.290	3			
Formal tools vs. edge-damaged (9 points)		-0.299	-0.829	7			
Formal tools vs. edge-damaged (5 points)	6.17	-0.517	-1.046	3			

* 5 points refers to only those 5 assemblages considered large enough to provide reliable data, while 9 points refers to all 9 pairs of data.

** For the sake of clarity, only significant results are indicated and are marked with an "S".

A quick analysis of the statistics presented in Table 6.2 shows the degree of variability in the late Holocene assemblages and enables some general conclusions to be drawn. Some correlations are more significant when calculated on the five larger assemblages only, indicating that the smaller assemblages are often providing spurious data. Interestingly though, some show higher significance on the nine assemblages. There are also two occasions when the correlation switches from positive to negative between the five and 9 point coefficients. These factors, and a consideration of the generally very low T-statistics, support the contention that overall, the samples are both too few in number, and too small in size for such statistical analyses to be effective

Quartz dominates all assemblages from this period, with most showing at least five times more quartz than any other raw material (Figure 6.1). These figures are calculated with the chips excluded, and inclusion of this class would result in far higher values. A ratio of

approximately 5:1 can probably be taken as fairly average for this time. The exceptionally high value for DFM 1 is certainly a result of the very specific set of stone tool-making activities carried out at the site, while that from PKM (880 BP) is based on a small assemblage and is not readily explained by the available evidence.

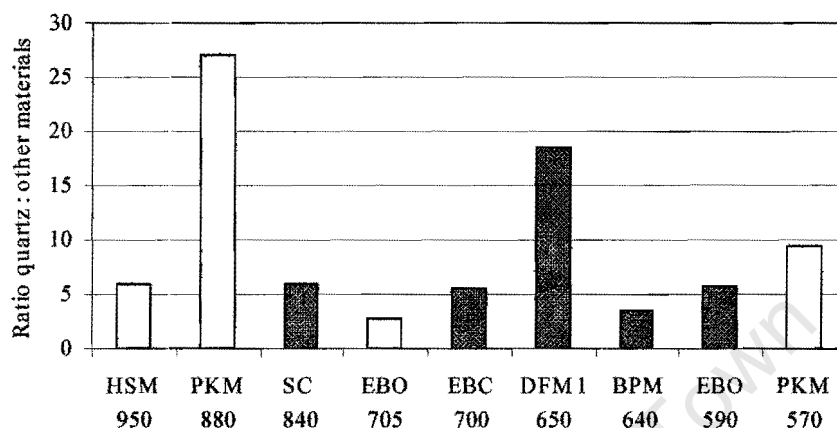


Figure 6.1 The ratio of quartz to all other materials in assemblages dating between 950 and 570 BP.

Figure 6.2 compares the total proportions of quartz and bipolar cores. The five larger assemblages show a strong correlation ($r = 0.893$), while the smaller ones clearly contain spurious frequencies, probably most evident in the values for bipolar cores. The quartz-rich assemblages tend to be more strongly bipolar, as would be expected, since quartz is most easily worked in a bipolar manner due to the general size and nature of the available nodules. No significant correlation exists between quartz and non-bipolar cores (Table 6.2).

Quartz and blades are not strongly related (Table 6.2), although the slightly better correlation ($r = 0.683$) when only the five larger assemblages are used, does suggest that blades might be more likely produced in quartz-rich assemblages. The four zero frequencies for blades, however, make further interpretation difficult.

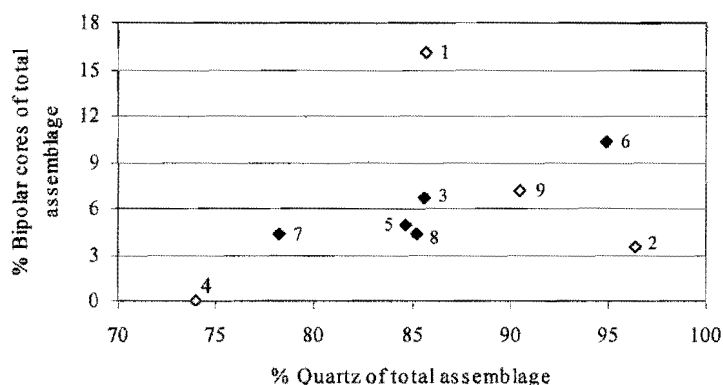


Figure 6.2 The relationship between quartz and bipolar cores in assemblages dating between 950 and 570 BP.

Figures 6.3 and 6.4 compare quartz with flake and chunk frequencies respectively. Although the total sample of nine assemblages shows a measure of correlation significant at the 20% level for flakes ($r = 0.482$) and the 10% level for chunks ($r = -0.612$), it is clear from the figures that no correlation exists when only the large assemblages are considered. Since flakes and chunks comprise most of the assemblages when chips are omitted, the two figures are almost exactly the complement of each other.

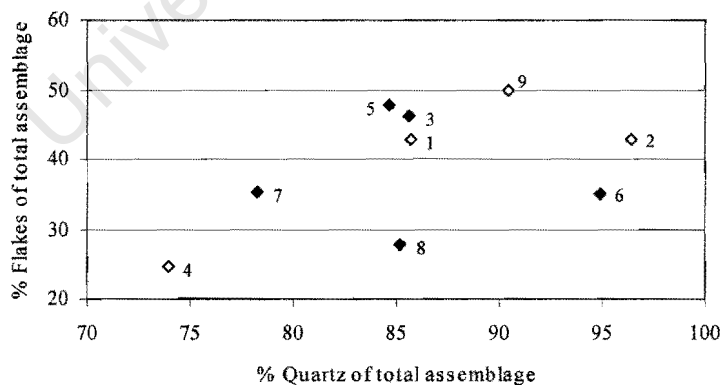


Figure 6.3 The relationship between quartz and flakes in assemblages dating between 950 and 570 BP.

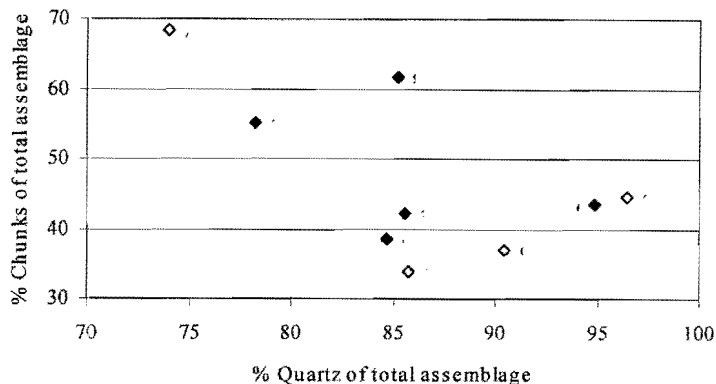


Figure 6.4 The relationship between quartz and chunks in assemblages dating between 950 and 570 BP.

Edge-damaged pieces are negatively related to the frequency of quartz ($r = -0.093$; Figure 6.5), but the relationship is obscured by one wayward point (PKM 880 BP, number 2), which represents the smallest assemblage and is quite likely spurious. When just this point is omitted, the correlation improves dramatically ($r = -0.812$; $T = -3.407 < -t_6$ at the 5% level). In Section 3.2.3 it is explained that edge-damaged pieces can be produced as a result of a variety of factors, one of which is, of course, the use of the artefacts. The clear correlation evident above, suggests that, rather than random factors, it is in fact their use that is responsible for the damage. Interestingly, the negative correlation means that as the overall quartz frequency increases, so the proportion of edge-damaged pieces decreases. This suggests two possible scenarios which may have occurred simultaneously. Materials other than quartz may have been targeted for utilisation, as might have been the case at EBO (705 BP) (number 4), BPM (number 7) and EBC (number 5), which each have an equal number or less edge-damaged pieces in quartz than in other materials. Each of these assemblages also shows high overall frequencies of non-quartz materials, further supporting this notion. The second scenario, which would apply to the quartz-rich sites, would have people only requiring a certain number of good flakes for utilisation, such that as flaking continued at the

site, those same flakes were repeatedly used without many new ones being selected for use. This may be the case at DFM 1 (number 6) and PKM (570 BP) (number 9).

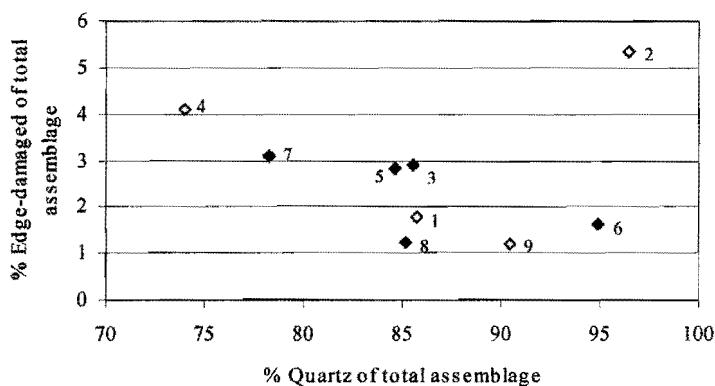


Figure 6.5 The relationship between quartz and edge-damaged pieces in assemblages dating between 950 and 570 BP.

Curiously, while this decreasing frequency of edge-damaged pieces occurs in the company of increasing quartz, the proportion of edge-damaged pieces made in quartz increases ($r = 0.840$; Figure 6.6). The edges produced on quartz must, therefore, have been more desirable than similar edges produced in other materials, because of both their sharpness and durability.

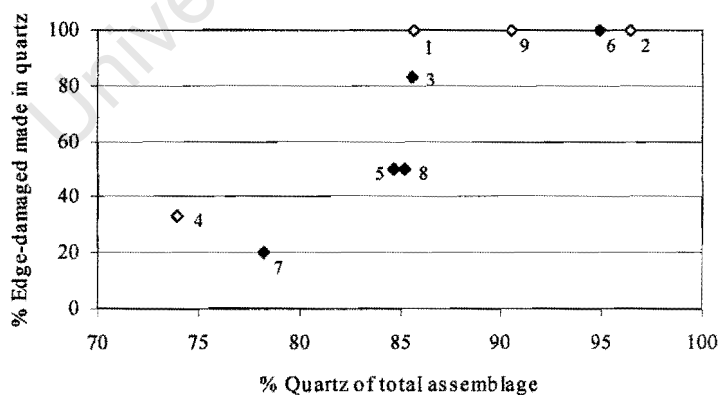


Figure 6.6 The relationship between quartz and edge-damaged pieces made in quartz in assemblages dating between 950 and 570 BP.

In Figure 6.7, the frequency of formal tools is plotted against that of quartz. Those assemblages with more quartz tend to contain more formal tools ($r = 0.576$), although the correlation is much stronger with the smaller assemblages excluded ($r = 0.903$). The stone tools from DFM 1 (number 6) were clearly influenced by a set of planned activities, since the entire industry is geared towards the production of tiny backed bladelets and points, the likes of which are seldom seen in any other western Cape assemblage from this period. I believe that it was this dedication to backed bladelet production, coupled with the fact that many of these artefacts broke, either during manufacture or use, that has resulted in the higher formal tool frequencies at the site. When the DFM 1 lithics are excluded, the correlation becomes considerably weaker and less likely to hold true ($r = 0.411$; $T = 1.104 < t_6$ at the 20% level). This suggests that, despite the high significance level, the correlation above ($r = 0.903$) should be regarded with caution.

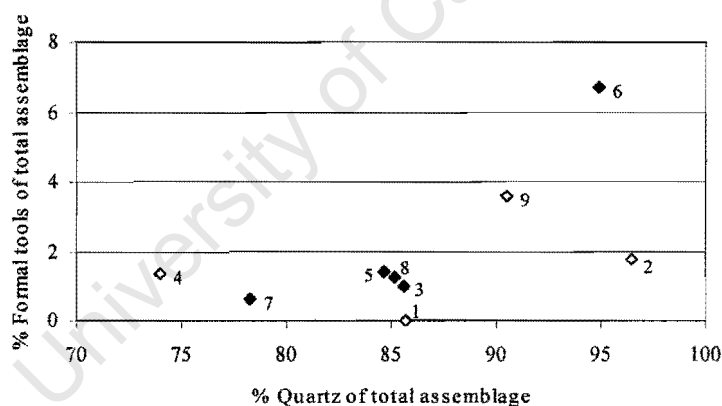


Figure 6.7 The relationship between quartz and formal tools in assemblages dating between 950 and 570 BP.

Figure 6.8 shows only a weak positive correlation between the overall frequency of quartz and the frequency of quartz among the formal tools alone ($r = 0.353$), although this strengthens when the small assemblages are excluded ($r = 0.754$). Given the low overall

numbers of tools, and that four of the assemblages have no formal tools made in quartz, there seems little point attempting further interpretation.

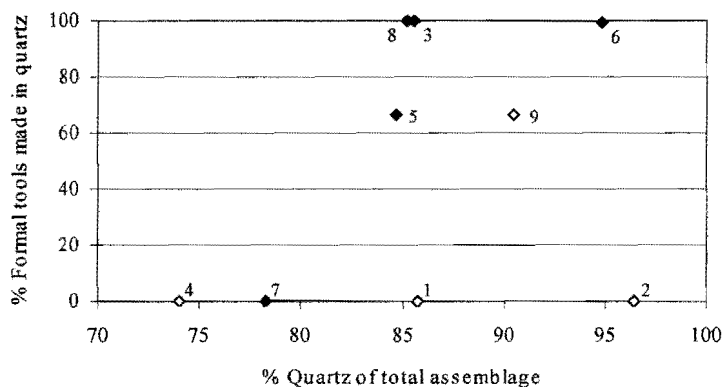


Figure 6.8 The relationship between quartz and formal tools made in quartz in assemblages dating between 950 and 570 BP.

When the ratio of bipolar cores to other core types is considered, we see that there are always at least 1.8 times more bipolar cores (Figure 6.9), with the zero value for EBO (705 BP) simply being due to the complete absence of cores in that assemblage. PKM (570) has 6 bipolar cores and no other cores such that a ratio cannot be calculated, but it would be reasonable to assume its true ratio to be at least 6. DFM 1, although containing many finely crafted formal tools, is considered to have been the result of expedient planning as reflected by the single raw material dominance and the high frequency of bipolar cores.

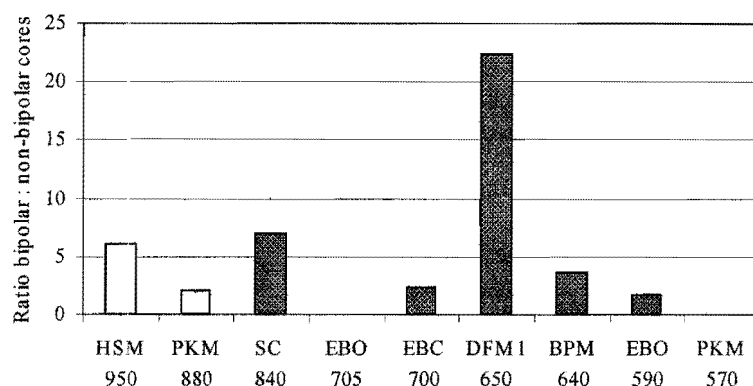


Figure 6.9 The ratio of bipolar cores to non-bipolar cores in assemblages dating between 950 and 570 BP.

Barham (1989b) suggests that a blade : core ratio of 1:1 or greater may indicate intentional bladelet production. At Elands Bay this ratio is never reached. Figure 6.10 shows a positive correlation between bipolar cores and blades and bladelets in these late Holocene assemblages ($r = 0.743$). This is misleading, however, since no highly significant correlation exists when only the large assemblages are considered ($r = 0.420$), and we know that bladelets were either not produced at all, or were made in fairly high numbers. With the frequency of blades being higher at this time than in preceding millennia (Figure 5.27), it is unlikely that they were all produced by chance, and the bipolar technique is most likely to have been responsible for them. Since only four assemblages contain both bladelets and non-bipolar cores, it is not possible to say comprehensively whether these cores may have produced the bladelets, but based on the low r and T values (Table 6.2), this seems highly unlikely.

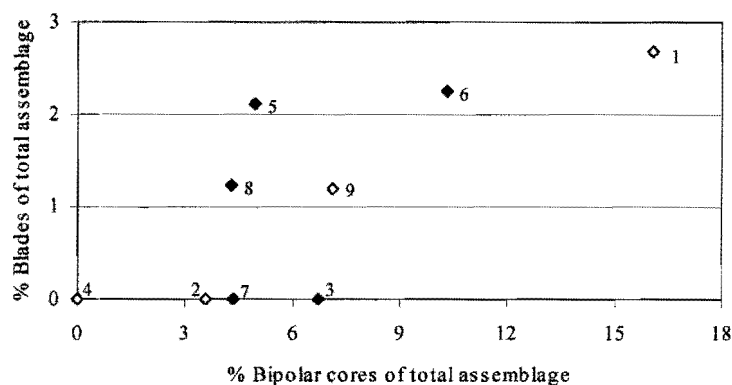


Figure 6.10 The relationship between bipolar cores and blades in assemblages dating between 950 and 570 BP.

Point number 5 is from EBC. Its position above the general relationship is not due to fewer cores, but rather to the fact that a smaller proportion of its cores are bipolar. This forms part of an interesting pattern which sees EBC consistently containing higher frequencies of non-bipolar cores over the last two millennia.

No significant correlation exists between bipolar cores and flakes ($r = 0.400$; Figure 6.11), while non-bipolar cores show almost no correlation with flakes (Table 6.2). This is probably a result of the variable input of flakes from both types of cores.

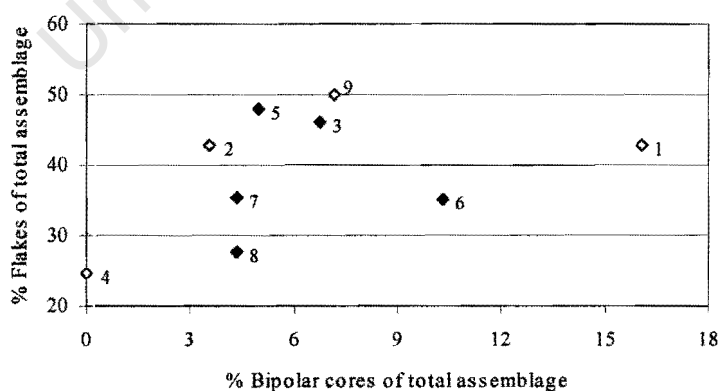


Figure 6.11 The relationship between bipolar cores and flakes in assemblages dating between 950 and 570 BP.

The bipolar experiments presented in Appendix 1 suggest that, despite the fracture qualities of quartz, assemblages created via the bipolar flaking technique should have relatively fewer chunks present in them. This holds true for the 950 to 570 BP assemblages ($r = -0.722$; Figure 6.12), although it may still be unreliable, since the correlation is less clear for the five larger assemblages alone ($r = -0.496$). No such pattern is discernible between chunks and non-bipolar cores (Table 6.2).

Since bipolar cores are more common in quartz-rich assemblages (Figure 6.2) and edge-damaged pieces are rarer in the same (Figure 6.5), we would expect bipolar cores and edge-damaged pieces to correlate negatively. Figure 6.13 shows this to be true ($r = -0.556$), although the correlation becomes much weaker when only the larger assemblages are used ($r = -0.306$). It is probably safe to assume that there is, in fact, a negative correlation present between these two variables.

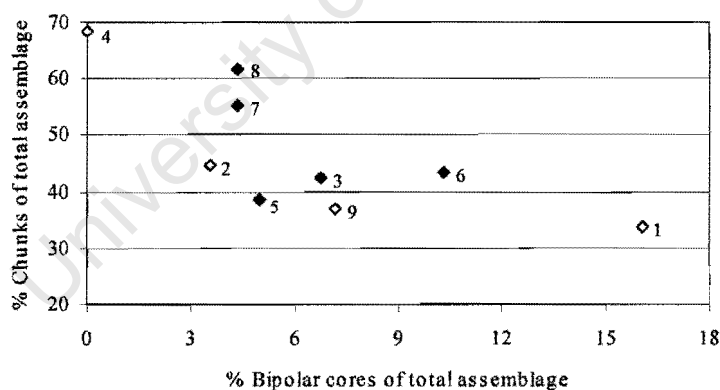


Figure 6.12 The relationship between bipolar cores and chunks in assemblages dating between 950 and 570 BP.

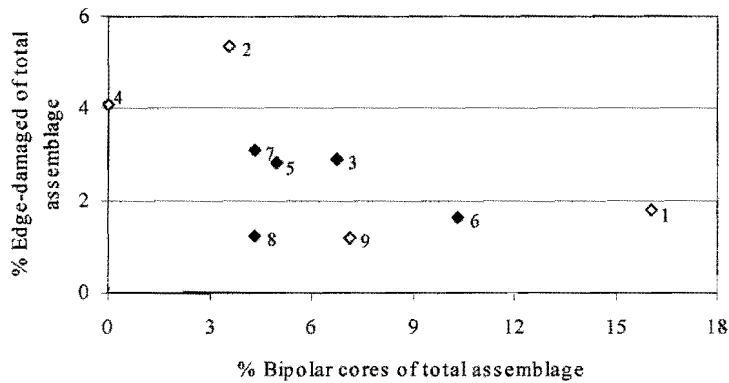


Figure 6.13 The relationship between bipolar cores and edge-damaged pieces in assemblages dating between 950 and 570 BP.

The relationship between bipolar cores and formal tools ($r = 0.131$; Figure 6.14) is rather ambiguous, with two interpretations possible. It is clear, however, that the values for HSM (number 1) are the only real outliers, since, when just this pair is excluded, the correlation becomes much stronger ($r = 0.731$; $T = 2.626 > t_6$ at the 5% level). This suggests that more strongly bipolar assemblages are likely to contain higher frequencies of formal tools. An alternative view would consider the tight clustering to suggest that these values are very much the average frequencies to be expected for both bipolar cores and formal tools at this time. The DFM 1 assemblage (number 6) is unique and expediently manufactured, such that it in no way reflects an 'average' post-1000 BP assemblage from the Elands Bay area. Owing to the significance of DFM 1, and the fact that well crafted retouched tools are not typical of expedient assemblages (Nelson 1991 and references therein), I would suggest the latter interpretation of Figure 6.14 to be the more plausible. Non-bipolar cores show just the opposite correlation ($r = -0.670$; Figure 6.15), as would be expected. As is the case above, the cluster is more likely to suggest 'average' values, with the other assemblages being outliers.

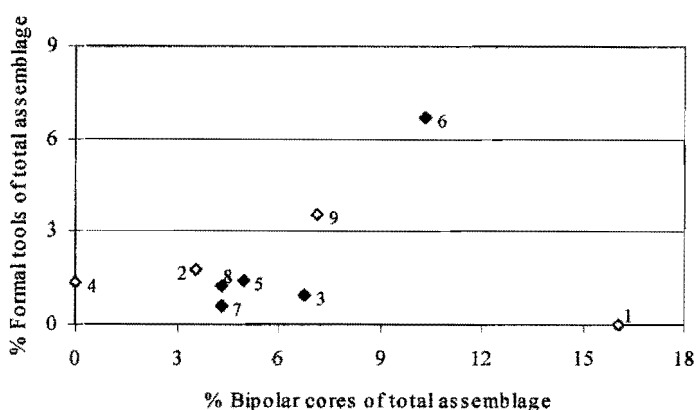


Figure 6.14 The relationship between bipolar cores and formal tools in assemblages dating between 950 and 570 BP.

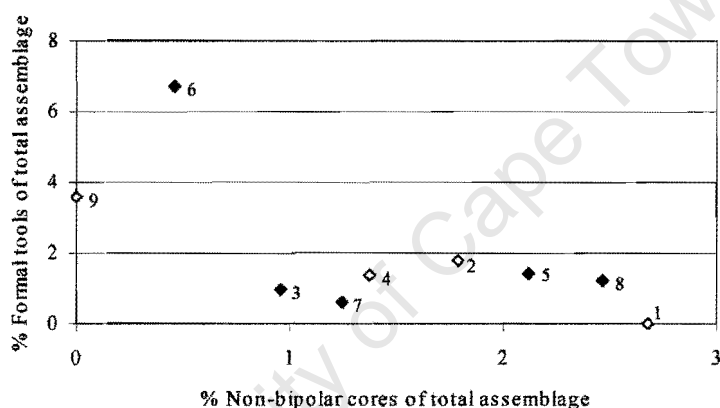


Figure 6.15 The relationship between non-bipolar cores and formal tools in assemblages dating between 950 and 570 BP.

Figure 6.16 plots the relationship between formal tools and edge-damaged pieces as a ratio. It is clear that during the first half of this period formal tools are far less important than edge-damaged pieces, with the ratio of formal tools to edge-damaged pieces never exceeding 0.5 in the five earlier assemblages. With the post-570 BP assemblages showing elevated ratios (the values being 2, 1 and 0.8 respectively), it seems that retouched pieces became more important in the carrying out of daily tasks requiring stone implements. While the later values in Figure 6.16 are somewhat irregular, they are in sharp contrast to the consistently low values in the

first part of the period, reinforcing the suggestion that formal tools were relatively unimportant through the first few centuries of the last thousand years. Based on the fact that either one or the other generally dominates, similar functions for formal tools and edge-damaged pieces can therefore be suggested.

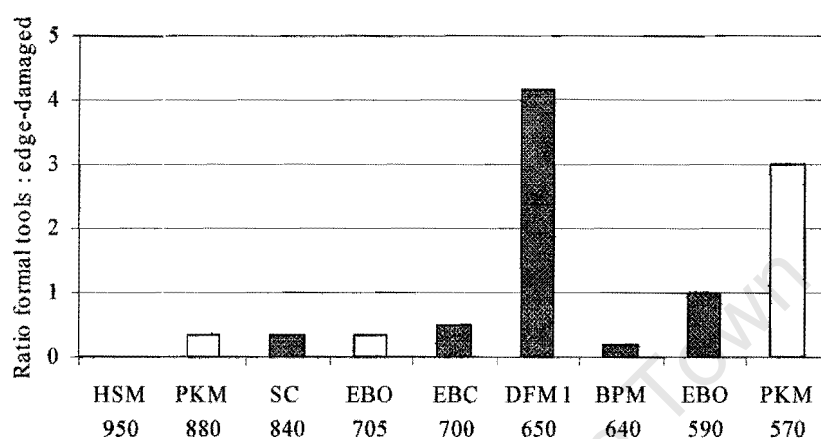


Figure 6.16 The ratio of formal tools to edge-damaged pieces in assemblages dating between 950 and 570 BP.

Most edge-damaged pieces possess sharp cutting edges with rather few having been used in a scraper-like fashion. These sharp-edged pieces are best compared with backed bladelets and backed flakes, each of which generally has a similar edge. The comparison is well illustrated at DFM 1, where many of the backed bladelets display extensive damage to their sharp edges (Orton 1998). With only three sites containing these backed tools, however, a comparison with edge-damaged pieces is impractical.

Figure 6.17 shows the frequencies of formal tools and edge-damaged pieces plotted against one another. If they were put to similar uses then we would expect a negative correlation in which either one or the other is more strongly present. To some degree this is slightly evident

($r = -0.299$), and, if one considers the black diamonds alone, the correlation is a little stronger ($r = -0.517$), although EBO (590 BP, number 8) shows very low frequencies of both types of artefacts. An alternative (positive) correlation ($r = 0.600$; $T = 1.675 > t_5$ at the 20% level) also exists if one ignores points 6 and 9 (DFM 1 & PKM (570 BP) respectively), which, with such high formal tool counts, can be considered outliers anyway. This second interpretation may be the more satisfactory, although, with two possible underlying correlations evident, and very low significance for the correlations (Table 6.2), further interpretation of this small data set is impractical.

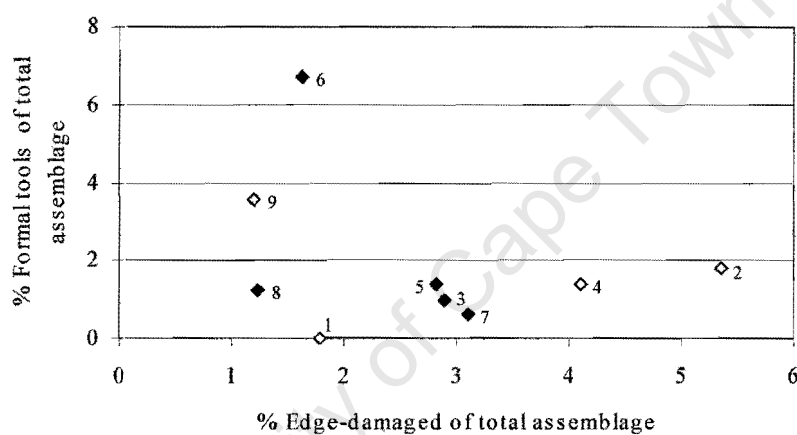


Figure 6.17 The relationship between formal tools and edge-damaged pieces in assemblages dating between 950 and 570 BP.

Unfortunately, other than at DFM 1, very few formal tools are present in these late assemblages. As a result, little comparative analysis can be carried out on them. One point on raw materials, however, can still be made. Formal tool raw material composition is quite variable, with three assemblages having only quartz formal tools, and three others only tools in other materials. These latter, however, are each represented by just one tool.

6.2.3 Summary and discussion

Between 950 and 570 BP people were focussing their search for raw materials on the most conveniently accessible local stone with little attention being paid to other materials. Besides quartzite and sandstone, quartz is the most readily accessible material and it is this which dominates the assemblages with about 80% of all artefacts having been made in it. Due to the difficulty in flaking quartz by non-bipolar means, the bipolar technique was clearly the favoured mode of reduction of this material. Although bladelets and flakes were most likely produced primarily via this technique, it is quite clear that those blanks favoured for retouch were undoubtedly the result of bipolar flaking. This flaking method also clearly produced fewer chunks than non-bipolar flaking.

In assemblages with high overall quartz proportions, edge-damaged pieces are generally relatively less frequent, and also far more likely to be made of quartz. Edge-damaged pieces are mostly utilised artefacts, since most assemblages are dominated by either these or formal tools, suggesting that they performed similar functions to retouched tools. It is clear that the sharp edges formed on quartz flakes were prized for use over those on other materials.

With most excavations being fairly small and recovering very few formal tools, it is difficult to get a true reflection of what occurred at each site, and to be able to make comments on the spatial distribution of assemblages on the landscape. No patterns based on the type of site (cave, rock shelter or open) or the distance from Bobbejaansberg, and likely raw material sources, are evident. A clear point to have emerged, however, is that the assemblage from DFM 1 is obviously very different in many respects to all others from this period. It must have been produced with a single aim in mind, since its main features – the dominance of quartz, bipolar cores and backed bladelets – are all taken to the extreme. This assemblage

does share some of its features with others, although never do they combine to produce such an extraordinary phenomenon. The two assemblages from PKM are perhaps the most similar, with a high incidence of both quartz and bipolar flaking. The 590 BP assemblage from EBO is the only one, other than DFM 1, to contain backed bladelets.

6.3 TERMINAL PLEISTOCENE / EARLY HOLOCENE QUARTZ-POOR

ASSEMBLAGES

6.3.1 Introduction

In this section the nine assemblages falling between 11 050 BP and 8500 BP are considered. They comprise those assemblages falling within the terminal Pleistocene/early Holocene nonmicrolithic period, as well as those of the transitional periods occurring immediately before and after this time (Table 5.2). All come from Elands Bay Cave, since no other assemblages of comparable age have been excavated from the Verlorenvlei area. Both transitional periods have been included so that the changes in raw material and formal tool composition may be tracked throughout the entire duration of the period that characteristics of the nonmicrolithic industry are present. It is important to note that the term 'nonmicrolithic' is employed instead of 'macrolithic', since the assemblages are not typically macrolithic in the usual sense of the word. They normally contain débitage artefacts that are slightly larger than their microlithic counterparts, while some formal tools have an area of perhaps three to four times greater than typical microlithic tools. Following Wendt's (1972) criteria, extremely few artefacts would be macrolithic (one dimension >50 mm), with a good proportion still being microlithic (one dimension <25-30 mm).

Quartz proportions are generally low at this time, although the final two assemblages, representing the transition into the Holocene microlithic, have very high values (Figure 5.3).

The two assemblages in the earlier transitional period reflect the steady decline in quartz use present throughout the earliest assemblages examined by this research. The bipolar technique accounts for some 60% of the quartz cores (Figure 5.13). Blades and bladelets tend to be relatively scarce, although the earlier assemblages still maintain higher proportions as a carry-over from the late Pleistocene microlithic period (Figure 5.26). Scrapers show a general increase tending towards the high proportions seen in the Holocene microlithic period, with backed tools being almost entirely absent (Figure 5.39), and MRPs accounting for at least half the total tool count (Figure 5.44).

6.3.2 The data

In the figures in this section, the diamonds represent the five 10 000 BP to 8900 BP assemblages, the triangles the two pre-10 000 BP transitional assemblages, and the squares the two post-8900 BP transitional assemblages. All assemblages are considered large enough to provide reliable observations, with at least 160 pieces, excluding chips present in each. On the scatter plots in this section the sites are numbered as follows:

1: EBC (11 050 BP)	4: EBC (9650 BP)	7: EBC (8900 BP)
2: EBC (10 550 BP)	5: EBC (9500 BP)	8: EBC (8800 BP)
3: EBC (10 000 BP)	6: EBC (9300 BP)	9: EBC (8500 BP)

Correlation coefficients and t-test results based on both the five definite nonmicrolithic assemblages, as well as for the total sample of nine, are given in Table 6.3. Interpretations are based on the statistics from the five nonmicrolithic assemblages, while further interpretation based on all nine assemblages is provided only when necessary.

Table 6.3 Sample correlation coefficients and t-test results for the terminal Pleistocene/early Holocene assemblages (11 050 BP – 8900 BP).

Data set*	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion**		
					20%	10%	5%
Quartz vs. bipolar cores (5 points)		0.367	0.684	3			
Quartz vs. bipolar cores (9 points)		0.081	0.215	7			
Quartz vs. non-bipolar cores (5 points)	6.19	0.752	1.975	3	S		
Quartz vs. non-bipolar cores (9 points)		0.233	0.633	7			
Quartz vs. blades (5 points)		0.052	0.090	3			
Quartz vs. blades (9 points)		-0.251	-0.687	7			
Quartz vs. flakes (5 points)		0.554	1.151	3			
Quartz vs. flakes (9 points)		-0.009	-0.024	7			
Quartz vs. chunks (5 points)	6.20	-0.793	-2.254	3	S		
Quartz vs. chunks (9 points)		-0.086	-0.227	7			
Quartz vs. edge-damaged (5 points)	6.21	-0.321	-0.586	3			
Quartz vs. edge-damaged (9 points)		-0.434	-1.273	7			
Quartz vs. edge-damaged made in quartz (5 points)	6.22	0.884	3.279	3	S	S	S
Quartz vs. edge-damaged made in quartz (9 points)		0.195	0.526	7			
Quartz vs. formal tools (5 points)	6.24	0.927	4.296	3	S	S	S
Quartz vs. formal tools (9 points)		0.605	2.010	7	S	S	
Quartz vs. formal tools made in quartz (5 points)	6.25	0.975	7.579	3	S	S	S
Quartz vs. formal tools made in quartz (9 points)		0.660	2.322	7	S	S	
Bipolar cores vs. blades (5 points)		-0.295	-0.535	3			
Bipolar cores vs. blades (9 points)		0.469	1.403	7			
Non-bipolar cores vs. blades (5 points)		-0.042	-0.073	3			
Non-bipolar cores vs. blades (9 points)		-0.358	-1.013	7			

Data set*	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion**		
					20%	10%	5%
Bipolar cores vs. flakes (5 points)		-0.459	-0.894	3			
Bipolar cores vs. flakes (9 points)		0.103	0.275	7			
Non-bipolar cores vs. flakes (5 points)	6.28	0.700	1.699	3	S		
Non-bipolar cores vs. flakes (9 points)		0.563	1.803	7	S		
Bipolar cores vs. chunks (5 points)		0.213	0.378	3			
Bipolar cores vs. chunks (9 points)		-0.335	-0.941	7			
Non-bipolar cores vs. chunks (5 points)	6.29	-0.868	-3.028	3	S	S	
Non-bipolar cores vs. chunks (9 points)		-0.490	-1.487	7	S		
Bipolar cores vs. edge-damaged (5 points)		-0.662	-1.528	3			
Bipolar cores vs. edge-damaged (9 points)		-0.435	-1.279	7			
Non-bipolar cores vs. edge- damaged (5 points)		0.326	0.596	3			
Non-bipolar cores vs. edge- damaged (9 points)		0.301	0.836	7			
Bipolar cores vs. formal tools (5 points)		0.312	0.569	3			
Bipolar cores vs. formal tools (9 points)		-0.515	-1.591	7	S		
Non-bipolar cores vs. formal tools (5 points)		0.629	1.400	3			
Non-bipolar cores vs. formal tools (9 points)		0.269	0.739	7			
Formal tools vs. edge-damaged (5 points)		-0.389	-0.730	3			
Formal tools vs. edge-damaged (9 points)		0.017	0.046	7			
Quartz vs. scrapers (5 points)		0.474	0.933	3			
Quartz vs. scrapers (9 points)		0.762	3.111	7	S	S	S
Quartz vs. MRPs (5 points)	6.37	0.929	4.354	3	S	S	S
Quartz vs. MRPs (9 points)		0.142	0.380	7			

* 5 points refers to the definite nonmicrolithic assemblages only, while 9 points includes the four transitional assemblages.

** For the sake of clarity, only significant results are indicated, and are marked with an "S".

A glance through Table 6.3 shows that some correlations are higher and/or more significant on the five assemblages belonging to the relatively well defined core nonmicrolithic period, than on the full sets of nine pairs of data, which include the transitional assemblages. This confirms the notion of the latter being different, and supports the decision to label them ‘transitional’ in Chapter 5. As is the case with the late Holocene assemblages, the general lack of significant conclusions to the t-tests suggests that the assemblages are too few in number to be able to provide meaningful insight into the lithic industry.

Nonmicrolithic assemblages of this time typically contain relatively high frequencies of coarser-grained materials, with the main reason commonly assumed to be that such rocks come in larger pieces or nodules, allowing the production of larger flakes (Mitchell 2003; Wadley 1993). This may not be so straightforward though, and will be further explored below. Figure 6.18 shows the ratio of quartz to other materials, calculated without chips. At 10 000 BP this ratio is at its lowest (1:1), with values no greater than about 2.5 being present until 8900 BP.

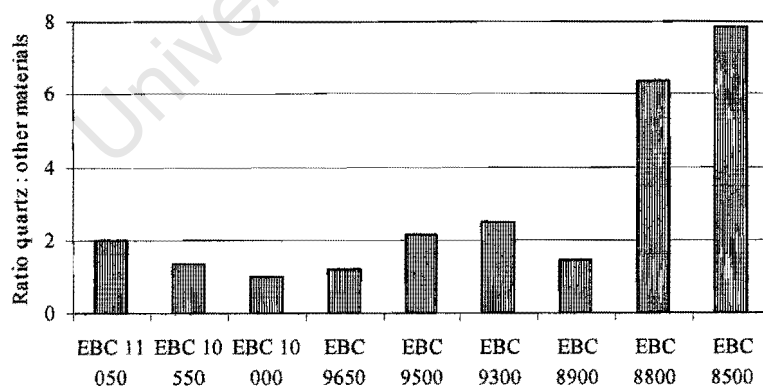


Figure 6.18 The ratio of quartz to all other materials in assemblages dating between 11 050 and 8900 BP.

At this point, what is perhaps the most abrupt change in the sequence took place, with quartz assuming the dominance that remains evident for the rest of the Elands Bay LSA. This change was part of the general shift towards the Wilton-type assemblages that were probably fully developed by about 8000 BP. Parkington (pers. comm.) has suggested that a relatively more rapid sea level rise at that time may have caused a sudden reduction in the availability of other materials, which, when compounded with the already increasing use of quartz, would have produced a much greater jump in the relative frequency of quartz between these two assemblages. Unfortunately, research into detailed local sea level curves is largely restricted to the mid- to late Holocene (see section 2.2.3), although Baxter (1997) has suggested, based on the evidence of sediments and fossil molluscs from Verlorenvlei, that the early Holocene rise was a rapid one. This early Holocene rise is consistent with that documented elsewhere (see Section 2.2.3). This could, therefore have contributed to the rapid increase in quartz use, although without more detailed sea-level data, it is impossible to be more conclusive.

Bipolar core frequency is most likely unrelated to quartz frequency at this time (Table 6.3), since we would expect either one or the other reduction technique to prevail, and non-bipolar cores do, in fact, show a far stronger correlation ($r = 0.752$; Figure 6.19), significant at the 20% level. While non-bipolar cores were undoubtedly the primary reduction focus, bipolar flaking would have been undertaken on some of the remaining cores, when suitable, in order to increase the yield of flakes per unit raw material. This indicates a vastly different approach to the working of this material compared with the last thousand years. Inclusion of the transitional assemblages reduces the latter correlation significantly (Table 6.3), suggesting that non-bipolar reduction was practised more frequently during the core nonmicrolithic period.

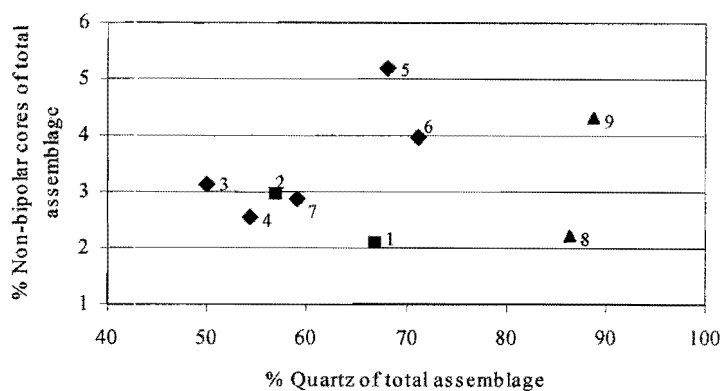


Figure 6.19 The relationship between quartz and non-bipolar cores in assemblages dating between 11 050 and 8900 BP.

Blades and flakes show no significant relationship to quartz at all (Table 6.3), but chunks appear to decrease as quartz frequencies rise ($r = -0.793$; Figure 6.20). In this case the earlier transitional assemblages (squares) follow the pattern, but the later ones (triangles), with their far increased quartz frequencies, appear not to. When these later assemblages are omitted from the correlation calculation, far better results are obtained ($r = -0.776$, $T = -2.753 < t_5$ at the 5% level). There is no change in core types evident at 8800 BP, leaving the relatively high frequency of chunks unexplained.

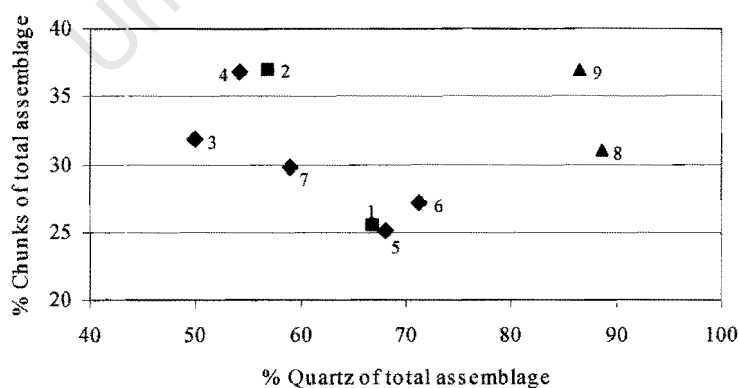


Figure 6.20 The relationship between quartz and chunks in assemblages dating between 11 050 and 8900 BP.

Edge-damaged pieces show a similar situation to that occurring in the post-1000 BP assemblages, although the pattern is somewhat weaker and uncertain. There is perhaps a slight tendency for edge-damaged pieces to be less frequent in quartz-rich assemblages ($r = -0.321$; Figure 6.21), although at the same time, edge-damaged pieces made in quartz clearly increase with total quartz ($r = 0.884$; Figure 6.22). Again though, the pattern is restricted to the core nonmicrolithic assemblages. As noted in Section 6.2.2, where a similar, but stronger pattern was noted for the late Holocene, this may have been due to the superior edge characteristics attainable on quartz.

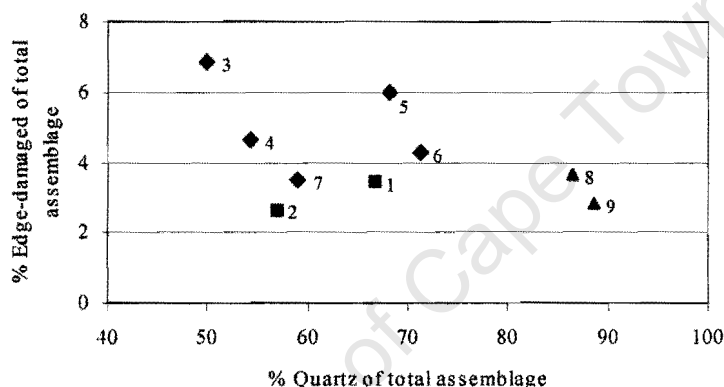


Figure 6.21 The relationship between quartz and edge-damaged pieces in assemblages dating between 11 050 and 8900 BP.

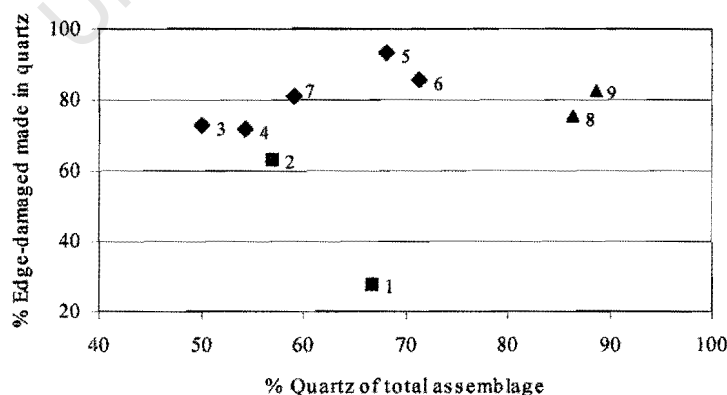


Figure 6.22 The relationship between quartz and edge-damaged pieces made in quartz in assemblages dating between 11 050 and 8900 BP.

Figure 6.23 shows the ratio of edge-damaged pieces in the total quartz assemblage to that in all other materials. This representation has been chosen for both edge-damaged pieces and formal tools (both here and in Section 6.4.2 below) because a straight comparison of these artefacts made in quartz to those made in other materials would be largely influenced by the overall frequency of the various raw materials. This comparison essentially discounts that factor, giving an idea of the relative importance of quartz and other raw materials to the particular artefact category. It is clear that quartz flakes were favoured for use over those in other raw materials. This domination increases with time, then decreases again, with a dramatic spike occurring at 9500 BP. There is a simultaneous increase in quartz use at this time, but of significantly smaller magnitude (Figure 6.18). In contrast, a massive increase in quartz use is evident at 8800 BP (Figure 6.18) but without the increased favouritism of quartz in the edge-damaged category (Figure 6.23). This suggests a clear pattern which saw people far preferring to use quartz edges than edges in other materials, but only during the nonmicrolithic period. The 'Wilton-type' feature of reduced quartz use for edge-damage and retouch clearly began appearing c. 8800 BP.

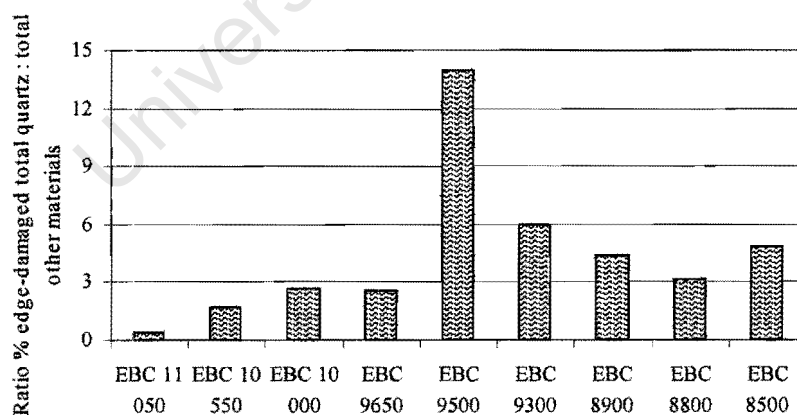


Figure 6.23 The ratio of the frequency of edge-damaged pieces among all quartz artefacts to the frequency of edge-damaged pieces among all artefacts in other materials in assemblages dating between 11 050 and 8500 BP.

Formal tools show a markedly different pattern to edge-damaged pieces and are very strongly related to quartz. As quartz frequencies increase, so more tools are made (0.927; Figure 6.24), and a higher frequency of them are made from quartz ($r = 0.975$; Figure 6.25). The pattern even holds across the transitional assemblages (Table 6.3), and with the high significance attached to these correlations, the relationship between quartz and formal tools is almost certainly real.

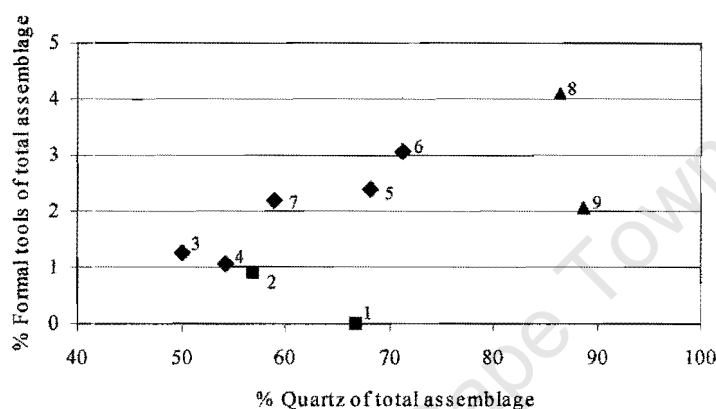


Figure 6.24 The relationship between quartz and formal tools in assemblages dating between 11 050 and 8500 BP.

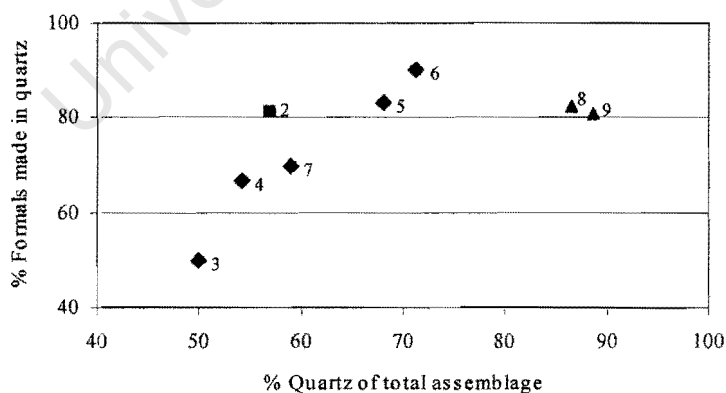


Figure 6.25 The relationship between quartz and formal tools made in quartz in assemblages dating between 11 050 and 8500 BP.

The position of the triangles in Figure 6.25 shows that just prior to the start of the Holocene microlithic period, relative to the total quartz frequency, other raw materials gained in their relative importance with regard to formal tool manufacture. This indicates the start of a trend which occurs fairly consistently through the Holocene until the start of the final millennium. Note that no tools were found in the 11 050 BP assemblage.

In Figure 6.26 the ratio of formal tools made in quartz to those made in other materials is presented. Interestingly, the same pattern as was seen with edge-damaged pieces (Figure 6.23) emerges, although here the peak is delayed by one assemblage. The high value at 10 550 BP is not readily explained. The similarity between formal tools (Figure 6.26) and edge-damaged pieces (Figure 6.23) reinforces the suggestion that there was a specific focus on quartz for retouch and use around 9500 to 9300 BP, and that 'Wilton' characteristics first began appearing about 8800 years ago.

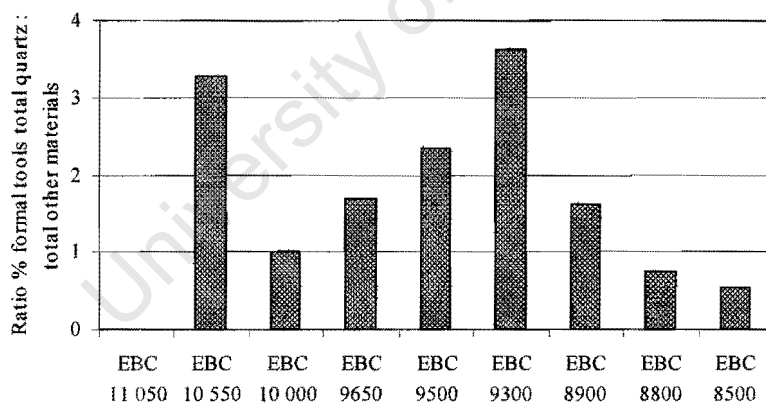


Figure 6.26 The ratio of the frequency of formal tools among all quartz artefacts to the frequency of formal tools among all artefacts in other materials in assemblages dating between 11 050 and 8500 BP.

At this time bipolar flaking is less popular, with irregular and single platform cores showing relatively higher frequencies than either before or after, but still being dominated numerically

by their bipolar counterparts (Figure 6.27). The high proportion of bipolar cores in the earliest assemblage (11 050 BP) is not readily explained, although it may partly be a carry-over from the late Pleistocene microlithic, when, especially at 13 600 BP, bipolar cores were far more frequent. The increase in non-bipolar cores is not as high as may have been expected, however, but is better illustrated by the difference between the mean values in each period, as given in Table 6.4.

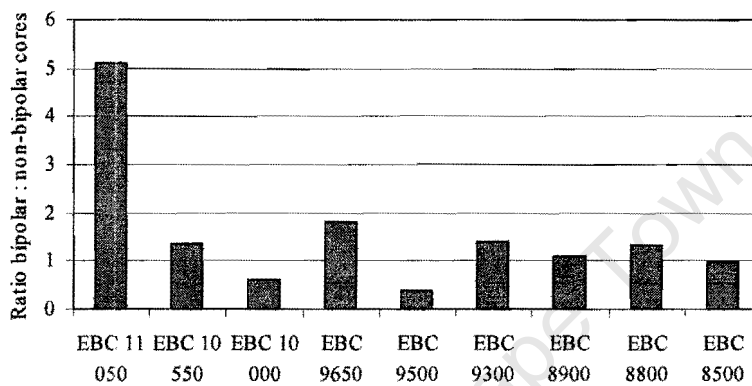


Figure 6.27 The ratio of bipolar to non-bipolar cores in assemblages dating between 11 050 and 8500 BP.

Table 6.4 Mean bipolar and non-bipolar core frequencies during the late Pleistocene and early Holocene.

Period	Mean bipolar core frequency (%)	Mean non-bipolar core frequency (%)
13 600 – 11 370 BP	4.73	2.93
11 050 – 10 550 BP	5.57	2.76
10 000 – 8900 BP	3.94	3.13
8800 – 8500 BP	3.55	3.23

This relative increase in non-bipolar flaking is undoubtedly due to the desire for larger flakes on which to manufacture the larger scrapers that characterise this period. Bipolar flaking still plays an important part in these assemblages though, and its role is discussed further in

Section 8.1. The 8800 and 8500 BP assemblages contain the greatest numbers of scrapers, and also show the biggest difference between the frequencies of bipolar and non-bipolar cores.

Neither the bipolar cores, nor the other cores show any correlation with blades and bladelets (Table 6.3), as is to be expected in a set of assemblages in which bladelet manufacture was neither common, nor intended. Despite the fact that bipolar cores are more numerous than other core types, they were clearly not the main mode of production of flakes (Table 6.3), although with low significance this cannot be guaranteed. When flakes are plotted against non-bipolar cores, however, a fairly clear positive correlation, significant at the 20% level, is obtained ($r = 0.700$; Figure 6.28), suggesting that most flakes were probably produced by non-bipolar means.

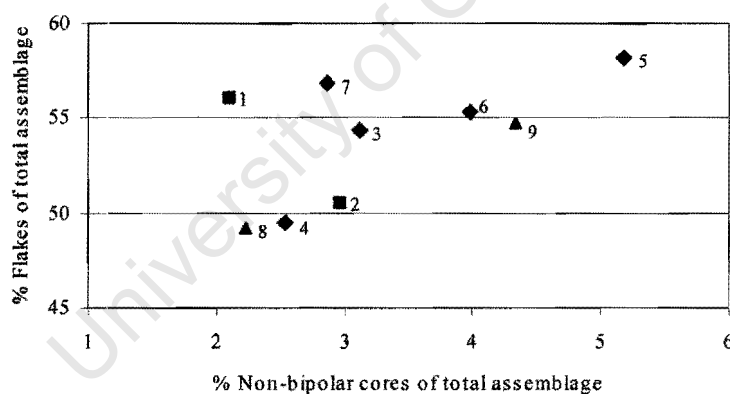


Figure 6.28 The relationship between non-bipolar cores and flakes in assemblages dating between 11 050 and 8500 BP.

While chunks are not correlated with bipolar cores (Table 6.3), they are negatively correlated with non-bipolar cores ($r = -0.868$; Figure 6.29), although the pattern becomes slightly weaker when the transitional assemblages are included ($r = -0.490$; Table 6.3). Interestingly,

the two points arguably falling furthest from the general relationship are the earliest (11 050 BP; number 1) and latest (8500 BP; number 9) transitional assemblages, suggesting that the other two are indeed closer to the nonmicrolithic assemblages in their character. When recalculated with only these two points omitted, the correlation is both high and significant ($r = -0.864$; $T = -3.843 < t_5$ at the 5% level). The lower numbers of chunks produced from non-bipolar cores reflects the successful production of flakes demonstrated in Figure 6.28.

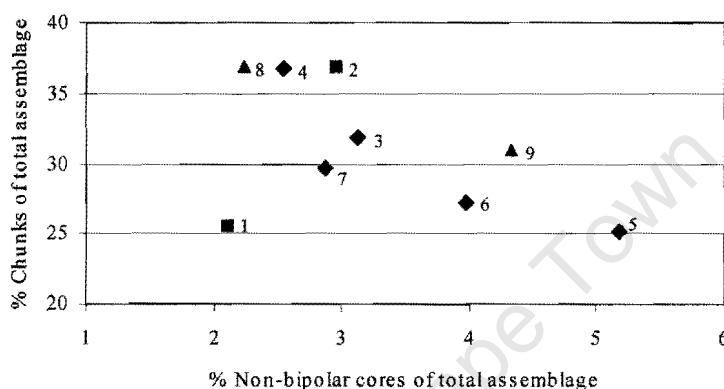


Figure 6.29 The relationship between non-bipolar cores and chunks in assemblages dating between 11 050 and 8500 BP.

Edge-damaged pieces correlate negatively with bipolar cores (Table 6.3), reflecting the positive and negative relationships that quartz demonstrates with bipolar cores and edge-damaged pieces respectively. They also show a weak positive correlation with non-bipolar cores (Table 6.3), perhaps reflecting only the fact that most flakes were the products of non-bipolar flaking (Figure 6.28). Similarly, the positive correlation between formal tools and non-bipolar cores (Table 6.3) must indicate the same thing. Unlike the assemblages dating after 1000 BP, there is clearly no correlation between bipolar cores and formal tools (Table 6.3), since a recalculation of the correlation coefficient based on all but the earliest transitional assemblage produces a value very close to zero ($r = -0.008$, $T = -0.020 > t_6$ at the 20% level)

Edge-damaged pieces and formal tools are expected to correlate negatively, since one or the other is usually more common. While the statistics do not provide a clear picture of this correlation (Table 6.3), Figure 6.30 shows that, in this case, edge-damaged pieces are more than twice as common until 9500 BP, although only once thereafter (8800 BP) does the ratio ever exceed 1. The pattern evident in Figure 6.30 reflects the greater situation quite nicely, showing the increase in formal tools leading out of the late Pleistocene microlithic period, and the start of the generally greater emphasis on retouched tools that continued throughout most of the Holocene microlithic period.

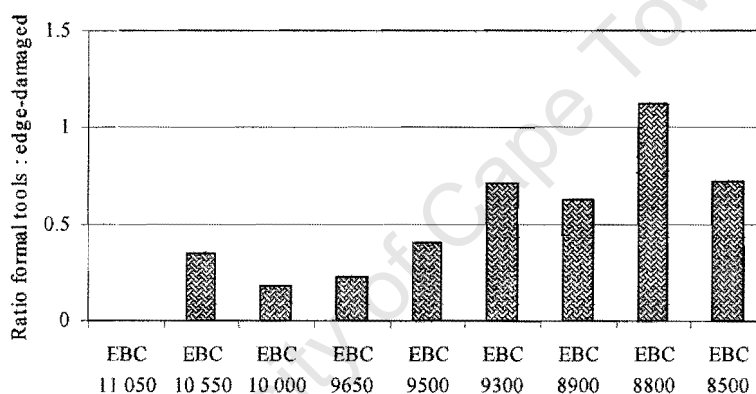


Figure 6.30 The ratio of formal tools to edge-damaged pieces in assemblages dating between 11 050 and 8500 BP.

The relatively large number of formal tools, most notably scrapers, from this period permits more detailed analysis of these artefacts than is possible for the late Holocene. The relative frequencies of scrapers, backed and other tools are presented in Figure 6.31. While scrapers are fairly important, other tools dominate, with backed elements being very infrequent. In both this and the following figure, the number of tools in each category is indicated alongside the appropriate bars.

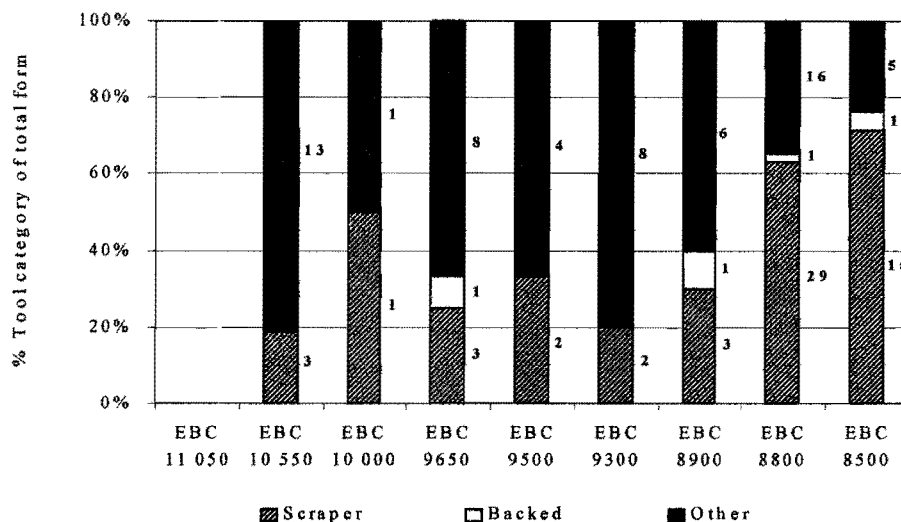


Figure 6.31 The formal tool composition of assemblages dating between 11 050 and 8500

BP.

MRPs typically comprise a considerable proportion of the other tools in most assemblages, and in the current sample this is certainly true. In Figure 6.32 they have been omitted such that a more accurate comparison of the relative importance of scrapers, backed tools and other recognisable retouched tools can be obtained. It is now quite evident that scrapers dominate the recognisable tool forms, with other tools, consisting mostly of adzes, being relatively unimportant. Backed tools are seldom seen but the presence of a single backed item in each of the last three assemblages does hint at the 'Wilton-type' assemblages which follow immediately afterwards, from c. 8000 BP.

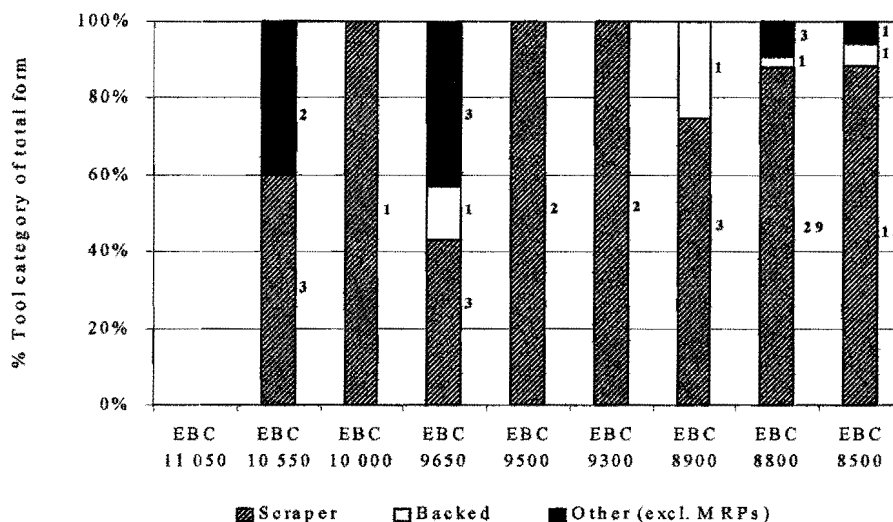


Figure 6.32 The formal tool composition with MRPs excluded of assemblages dating between 11 050 and 8500 BP.

Following on from the late Pleistocene, the overall frequency of formal tools in the nonmicrolithic period begins low, with values of about 1%. At 9500 BP, however, a dramatic increase takes place, which sees similar frequencies to those encountered throughout the Holocene begin to appear (Figure 5.38).

In Chapter 1, a general pattern, in which formal tools comprise lower frequencies among the quartz assemblages than among other raw materials, was outlined. Examples were, however, restricted to mid- and late Holocene assemblages. In other words all were Holocene microlithic or later. Figure 6.33 compares the frequency of formal tools in quartz and in all other raw materials combined. The obvious feature of the graph is the massive jump in the frequency of formal tools at 8800 BP, signalling the onset of the Holocene microlithic period. Clearly other materials were less favoured for retouch during the nonmicrolithic period, but became markedly more so at 8800 BP – also a sign of the approaching ‘Wilton-like’ period. It is interesting that this jump in the use of other raw materials for tool manufacture coincides exactly with the massive increase in both scraper manufacture and overall quartz use. To be considered along with these features, is the fact that, when more scrapers were made (Figure

6.32), quartz remained the preferred raw material for manufacture of these tools (Figure 6.34).

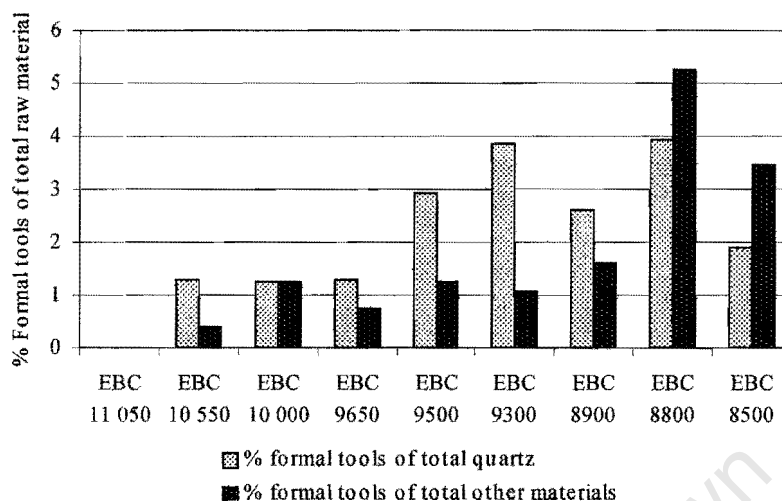


Figure 6.33 The frequencies of formal tools among all quartz artefacts and among all artefacts in other materials in assemblages dating between 11 050 and 8500 BP.

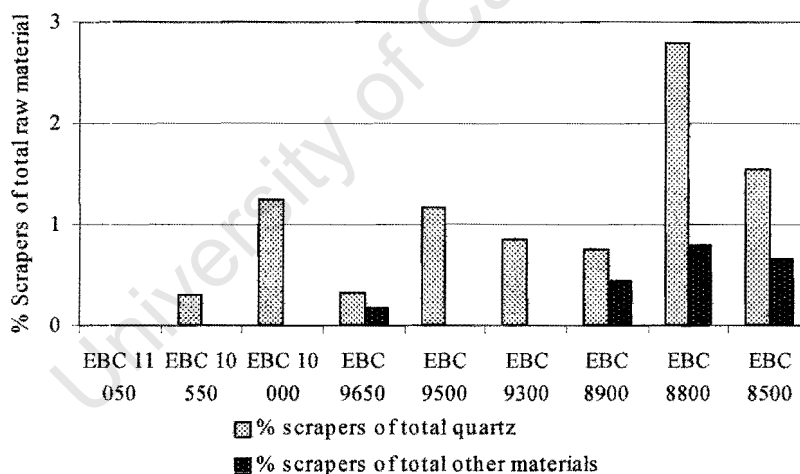


Figure 6.34 The frequencies of scrapers among all quartz artefacts and among all artefacts in other materials in assemblages dating between 11 050 and 8500 BP.

Scrapers strongly dominate the formal assemblages with quartz scrapers far outnumbering those in other materials (Figure 6.35). Despite this, no correlation exists between quartz and scrapers (Table 6.3). It should be noted that the apparently strong correlation when all nine

points are included in the calculation is certainly spurious, since the two later transitional assemblages are undoubtedly contributing the most to the correlation. A very clear trend towards increasing scraper frequencies is evident: the early transitional assemblages contain very few scrapers, a carry-over from the late Pleistocene microlithic period, while the core nonmicrolithic period shows consistent, but low frequencies. The distinct increase in the relative contribution of scrapers to the assemblages that is evident in Figure 6.31, is far more marked when scrapers are plotted as a proportion of the total assemblages (Figure 6.35). Scrapers were more commonly made in quartz, with other raw materials making an appearance in the later assemblages, but with their relative contribution remaining low (Figure 6.31). The number of scrapers in each assemblage can be found in Figure 6.31.

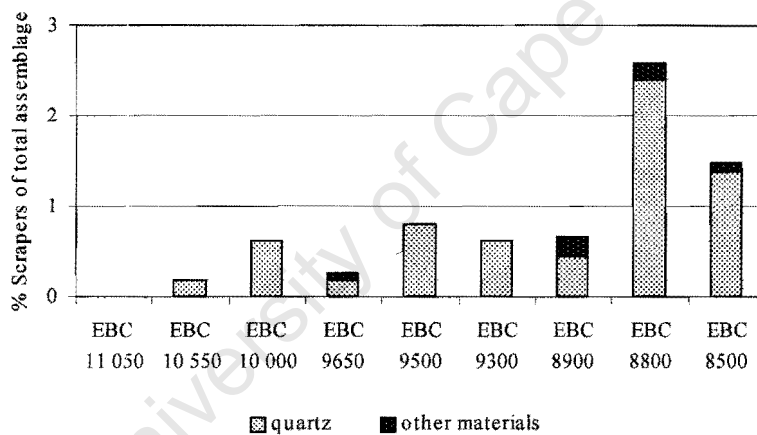


Figure 6.35 The frequency of scrapers in assemblages dating between 11 050 and 8500 BP.

Figures 6.31 and 6.32 have already demonstrated the relative contribution of miscellaneous retouch to the formal tools of this period. While non-quartz materials received little importance with regard to scraper manufacture, this was clearly not the case with MRPs (Figure 6.36). It is undoubtedly these tools that contribute the greatest to the high frequency of tools among materials other than quartz noted in Figure 6.33.

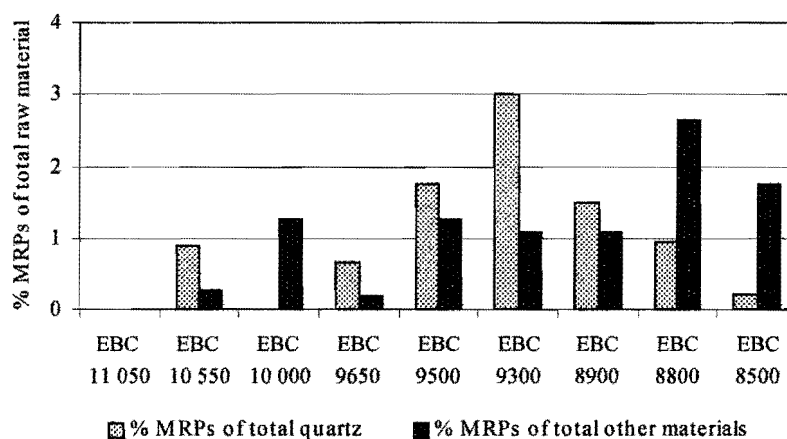


Figure 6.36 The frequencies of MRPs among all quartz artefacts and among all artefacts in other materials in assemblages dating between 11 050 and 8500 BP.

Despite this, MRPs still correlate strongly with quartz, being far more common when quartz is more frequently used ($r = 0.929$; Figure 6.37). It is important to note that each of the exceptions are transitional assemblages, and that their inclusion in the above correlation results in almost meaningless statistics (Table 6.3). The upper and lower triangles on the right represent the 8800 BP and 8500 BP assemblages respectively, and once again they indicate the start of a trend in which MRPs account for a consistently smaller proportion of all retouched pieces than before. The strong showing of scrapers, especially the big-D scrapers which occur at this time only, is probably a major reason for the lower frequency of MRPs in the later transitional assemblages. In Section 3.2.3 it was mentioned that artefact breakage might be a factor resulting in the presence of MRPs. The generally bigger scrapers at this time, and the big-D scrapers in particular, are made on larger than usual, chunky flakes, and would have been unlikely to suffer breakage during either manufacture or use.

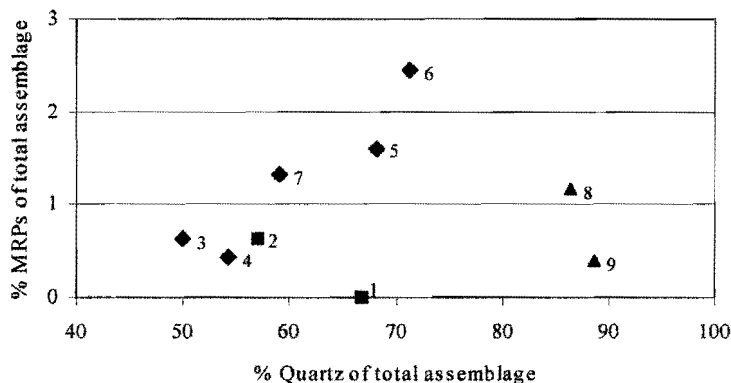


Figure 6.37 The relationship between quartz and MRPs in assemblages dating between 11 050 and 8500 BP.

Figure 6.38 shows the far greater contribution of other materials to the total MRP count than is the case with scrapers. A clear spike in MRP production occurs at 9300 BP, but this probably relates partly to the changing relative contribution of scrapers over time.

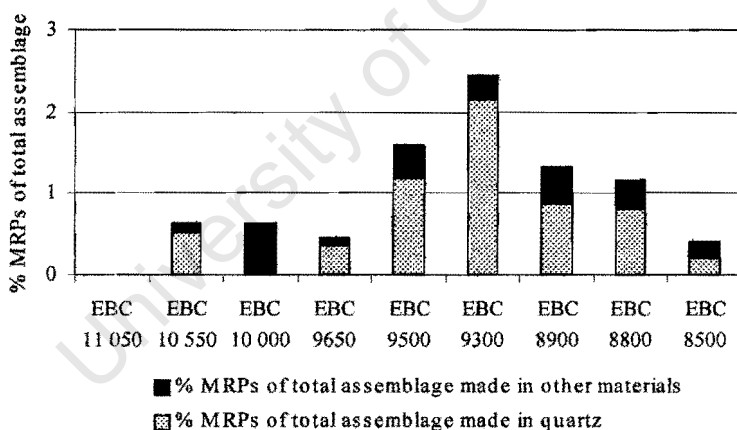


Figure 6.38 The frequency of MRPs in assemblages dating between 11 050 and 8500 BP.

6.2.3 Summary and discussion

Between 11 050 BP and 8900 BP the frequency of quartz is at its lowest, with a far wider variety of raw materials having been sought out and used. As mentioned above, it is commonly thought that the desire for larger flakes motivated the selection of materials other

than quartz at this time. At EBC, however, the situation may not be so simple. Throughout the nonmicrolithic period quartz is generally more common, with the ratio of quartz to other materials ranging between 1 and 2 (Figure 6.18). Comparison with the relative frequencies of edge-damaged pieces (3 to 6 times more common in quartz; Figure 6.23) and formal tools (1.5 to 3.5 times more common in quartz; Figure 6.26) among these materials, suggests that quartz was actually the preferred raw material. Other reasons must therefore be sought for the raw material changes evident at this time, although they may be restricted to the local area.

The bipolar technique was still extensively used, but the relative frequency of other types of cores suggests that both bipolar and non-bipolar techniques were used fairly frequently. Non-bipolar cores correlate more strongly with quartz than bipolar cores, however, suggesting that bipolar flaking was relatively less important overall for the reduction of quartz at this time. The industry appears to have been focussed on the production of flakes by non-bipolar means, although bipolar flaking probably succeeded other flaking techniques as a means of maximising flake production. Interestingly, both quartz and non-bipolar cores correlate negatively with chunks, unlike during the late Holocene, when only the former correlation applies. This suggests a greater efficiency in flake production from both methods of reduction.

Despite the considerable differences between the assemblages of this time and those of the post-1000 BP period, the edge-damaged artefacts from both periods show a similar pattern. The statistics unfortunately do not show the negative correlation between quartz and edge-damaged frequency very clearly, but in assemblages with high overall frequencies of quartz, edge-damaged pieces are far more likely to be made in quartz. As pointed out before, this

may have been due to the fine edge that could be produced on quartz, and which must have been favoured for use in cutting. At this time, when quartz is less frequent, this phenomenon is more readily explained. This period reflects the general decrease in the relative importance of edge-damaged pieces compared to formal tools, which extends from the late Pleistocene right up until 1000 BP.

Quartz was still used most consistently for the manufacture of formal tools, with both scrapers and MRPs more commonly made in quartz than other materials. Formal tool numbers are high enough to allow the frequency of quartz among them to be analysed. Interestingly, despite the large proportions of other raw materials present, people were still heavily focussed on quartz for the manufacture of formal tools, such that the ratio of quartz to other materials among the tools is consistently slightly higher than that in the overall assemblages. The transitional assemblages, especially the latter pair, don't follow this pattern very closely, thus reinforcing the idea that they are in fact not part of the core terminal Pleistocene/early Holocene nonmicrolithic period as defined in Table 5.2. Patterns among the cores, formal tools and raw materials are all explained in terms of a strategy of raw material conservation (Section 8.1).

The above analyses have allowed a characterisation of the nature of the transitional assemblages from this period. It is clear that few aspects of these assemblages appear to be 'intermediate', or watered-down versions of what came before and after. Rather, it has been shown that certain characteristics of the previous and succeeding industries have combined to form the assemblages that are here termed transitional. Tables 6.5 and 6.6 list the late Pleistocene microlithic, terminal Pleistocene/early Holocene nonmicrolithic and Holocene microlithic characteristics associated with each pair of transitional assemblages respectively.

Interestingly, overall formal tool frequencies do not change in the transitional assemblages, but rather, a sudden increase becomes apparent and is maintained from 9500 BP onwards (Figure 5.38).

Table 6.5 Assemblage characteristics of the 11 050 and 10 550 BP transitional assemblages.

Late Pleistocene microlithic characteristics	Terminal Pleistocene/early Holocene nonmicrolithic characteristics
<ul style="list-style-type: none"> • High bipolar core frequency • High blade and bladelet frequency • Low formal tool frequency • Low scraper frequency in quartz assemblage 	<ul style="list-style-type: none"> • Low overall quartz frequency • Absence of backed tools

Table 6.6 Assemblage characteristics of the 8800 and 8500 BP transitional assemblages.

Terminal Pleistocene/early Holocene nonmicrolithic characteristics	Holocene microlithic characteristics
<ul style="list-style-type: none"> • High non-bipolar core frequency • Greater frequency of scrapers made in quartz • Larger scrapers • Presence of NBKs 	<ul style="list-style-type: none"> • High overall quartz frequency • Greater frequency of edge-damaged and formal tools among materials other than quartz • High formal tool frequency • Higher ratio of formal tools : edge-damaged pieces • Lower frequency of MRPs • Presence of backed artefacts • Presence of thumbnail scrapers

The presence of such a wide array of raw materials in the nonmicrolithic assemblages may indicate that the people were exploiting a far wider area than in either earlier or later millennia, picking up bits of stone that they came across and fancied, but that quartz was still favoured for retouching. It could also suggest that other stone types were deliberately used at that time for odd tasks in order to conserve the more valuable quartz. Another interesting

point with regard to the presence of hornfels in EBC is raised by Parkington & Yates (in prep, a). They suggest that the hornfels NBKs may well have been obtained through trade or some other direct contact with the Karoo, a point to which I shall return later.

6.4 COMPARISON OF LATE PLEISTOCENE AND LATE HOLOCENE QUARTZ-RICH ASSEMBLAGES

6.4.1 Introduction

Here I focus on the four earliest assemblages of the sample. The first, dated to 13 600 BP, is clearly part of the main late Pleistocene microlithic tradition, while the following three, dating between 13 100 BP and 11 370 BP, still bear strong resemblance to the microlithic tradition, but yet show clear signs of industrial change tending towards the succeeding nonmicrolithic. These four assemblages are compared with the nine looked at in Section 6.2 in order to examine the use of raw materials and flaking techniques during two temporally distant periods, both of which show a clear focus on quartz and bipolar flaking.

The terminal Pleistocene assemblages show high, but steadily decreasing proportions of quartz (Figure 5.3), as well as a variable but dominant use of the bipolar technique (Figure 5.14). Bladelets are common in the 13 600 BP assemblage but markedly less so in the other three (Figure 5.27). Backed tools were clearly more often produced at 13 600 BP than later. MRPs generally comprise the most numerous class among the formal tools, while scrapers are rare.

All assemblages are large but unfortunately, with only four available for study during this period, patterns are not readily forthcoming. General comparisons with those assemblages dating between 950 and 570 BP can, however, still be made.

6.4.2 The data

In each scatter plot below, the 13 600 BP assemblage is represented by the diamond, with the remaining three assemblages shown by squares. The assemblages are numbered as follows:

- 1: EBC (13 600 BP) 3: EBC (13 020 BP)
2: EBC (13 100 BP) 4: EBC (11 370 BP)

Correlation coefficients and T-test results are given in Table 6.4. Due to the very small number of data points the T-values are low, with few significant conclusions being obtained.

Table 6.7 Sample correlation coefficients and t-test results for the late Pleistocene assemblages (13 600 – 11 370 BP).

Data set	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion*		
					20%	10%	5%
Quartz vs bipolar cores		0.047	0.067	2			
Quartz vs non-bipolar cores		-0.188	-0.270	2			
Quartz vs blades	6.39	0.970	5.627	2	S	S	S
Quartz vs flakes	6.40	0.517	0.855	2			
Quartz vs chunks	6.41	-0.620	-1.117	2			
Quartz vs edge-damaged		-0.294	-0.535	2			
Quartz vs edge-damaged made in quartz		0.482	0.778	2			
Quartz vs formal tools		-0.388	-0.595	2			
Quartz vs formal tools made in quartz	6.43	0.935	3.725	2	S	S	
Bipolar cores vs blades		0.164	0.235	2			
Non-bipolar cores vs blades		-0.356	-0.539	2			
Bipolar cores vs flakes	6.46	0.860	2.381	2	S		
Non-bipolar cores vs flakes		-0.068	-0.096	2			
Bipolar cores vs chunks	6.47	-0.763	-1.668	2			

Data set	Figure (when illustrated)	Correlation coefficient (r)	Test statistic (T)	Degrees of freedom (df)	Conclusion*		
					20%	10%	5%
Non-bipolar cores vs chunks		-0.324	-0.485	2			
Bipolar cores vs edge-damaged	6.48	-0.798	-1.876	2			
Non-bipolar cores vs edge-damaged		0.384	0.588	2			
Bipolar cores vs formal tools	6.49	0.886	2.699	2	S		
Non-bipolar cores vs formal tools		0.458	0.729	2			
Formal tools vs edge-damaged		-0.502	-0.820	2			

* For the sake of clarity, only significant results are indicated and are marked with an "S".

Most late Pleistocene microlithic assemblages are well-known to contain higher proportions of quartz than later assemblages (Wadley 1993; Mitchell 2003). The 13 600 BP assemblage at EBC is strongly dominated by quartz, while the ratio drops steadily as one approaches the nonmicrolithic period (Figure 6.38). With the pre-13 600 BP hiatus at EBC, we do not know how the frequency of quartz would have changed through the late Pleistocene. Frequencies of just over 90 % have been recorded at 17 800 BP (Parkington and Yates, in prep. a), while in the present 13 600 BP assemblage the value is 86 % (including chips). Considering the rapidity of the subsequent steady decline in the use of quartz, some consistency may well have occurred in the intervening millennia, had such assemblages been present at EBC.

Unlike during the late Holocene, when quartz and bipolar cores are strongly correlated, the assemblages of this time show no correlation between quartz and either bipolar or non-bipolar cores (Table 6.7). This is probably due to the use of different flaking techniques in an effort to conserve raw material.

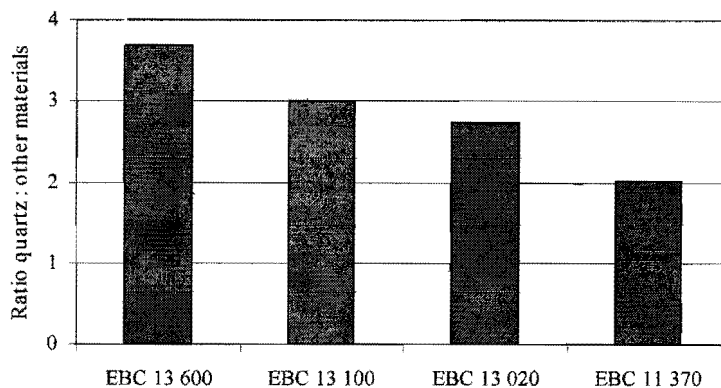


Figure 6.38 The ratio of quartz to all other materials in assemblages dating between 13 600 and 11 370 BP.

With late Pleistocene assemblages being characterised by the dominance of quartz and the presence of many bladelets, a correlation can be expected between these two variables. This correlation does occur and is highly significant ($r = 0.970$; Figure 6.39). It shows that during the late Pleistocene quartz bladelets were clearly the manufacturing focus of the lithic industry. Flakes, on the other hand, show a weaker correlation, although it might be expected to strengthen with more data points ($r = 0.517$; Figure 6.40). It should be noted that, on this and all subsequent histograms in this section involving quartz, the points fall in temporal order with the youngest assemblage on the left. As such, the y-axis variable can also be examined temporally. In this case it is clear that blades and bladelets decrease with time as the nonmicrolithic approaches.

As occurs in the late Holocene (Figure 6.4), the frequency of chunks correlates negatively with that of quartz ($r = -0.620$; Figure 6.41). The bipolar experiments (Appendix 1) have shown that this is to be expected in bipolar core dominated assemblages.

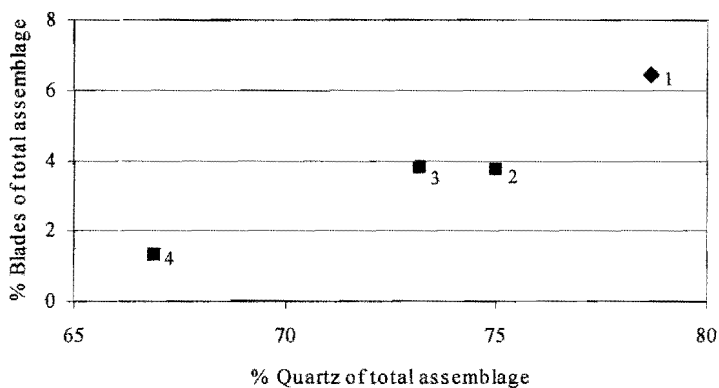


Figure 6.39 The relationship between quartz and blades in assemblages dating between 13 600 and 11 370 BP.

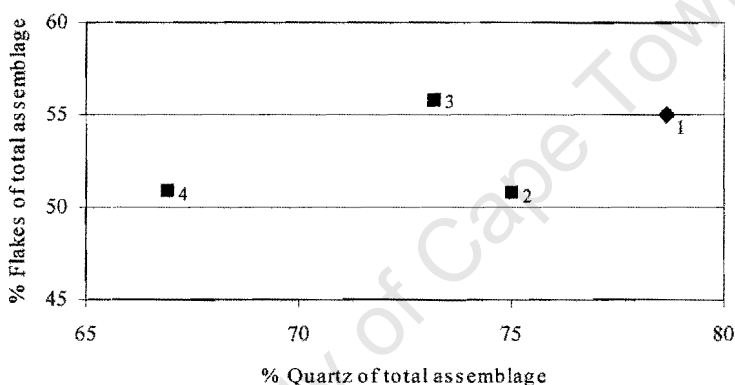


Figure 6.40 The relationship between quartz and flakes in assemblages dating between 13 600 and 11 370 BP.

After the negative correlations shown between edge-damaged pieces and quartz in the other periods, we would expect a similar correlation during the late Pleistocene. This only occurs very weakly (Table 6.7). In conjunction with this, the other periods also show a positive correlation between quartz and the frequency of edge-damaged pieces made in quartz. Again, this correlation is only weakly developed for the late Pleistocene (Table 6.7). In the later periods under analysis here, these correlations are stronger, the late Holocene one significantly so. As such, it is likely that with more assemblages in the late Pleistocene, a similar pattern would be evident.

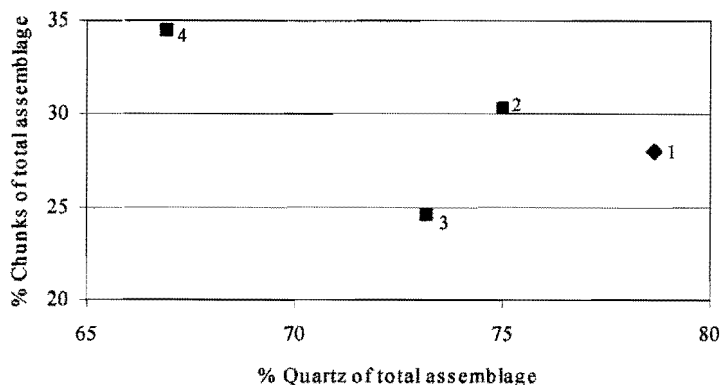


Figure 6.41 The relationship between quartz and chunks in assemblages dating between 13 600 and 11 370 BP.

Figure 6.42 shows the ratio of frequencies of edge-damaged pieces among quartz and other materials. The relatively larger contribution of quartz that might be expected in the 13 600 BP assemblage is not present, with other materials being used fairly often. The graph shows a peak at 13 020 BP that is explained by the relatively low total number of silcrete and CCS artefacts in that assemblage such that the contribution of other raw materials to the ratio is particularly small then. It is still clear in the two older assemblages that at least two to three times more quartz flakes gained damaged edges than flakes in other materials. Unfortunately, with so few late Holocene artefacts in materials other than quartz, no comparison can be made with that period.

While the overall quartz frequency shows only a weak negative correlation with the frequency of formal tools (Table 6.7), a strong positive correlation exists with the frequency of tools made in quartz ($r = 0.935$; Figure 6.43). This latter correlation is significant at the 10% level and suggests that as the overall focus on quartz decreased, so too did the desire to manufacture tools from quartz. Interestingly, only at 13 600 BP is the frequency of formal tools made in quartz greater than the overall quartz frequency, suggesting that it was only

during the late Pleistocene microlithic proper that quartz was strongly emphasised for retouch (see also Figure 6.44 below). This contrasts with the post-1000 BP assemblages, in that the latter display far more variability with some assemblages showing a complete focus on quartz for retouch, some showing a mixture and others having no quartz tools at all. Unlike the late Pleistocene, during which the pattern is strongly temporal, the late Holocene variability is variable throughout the 400 years under observation.

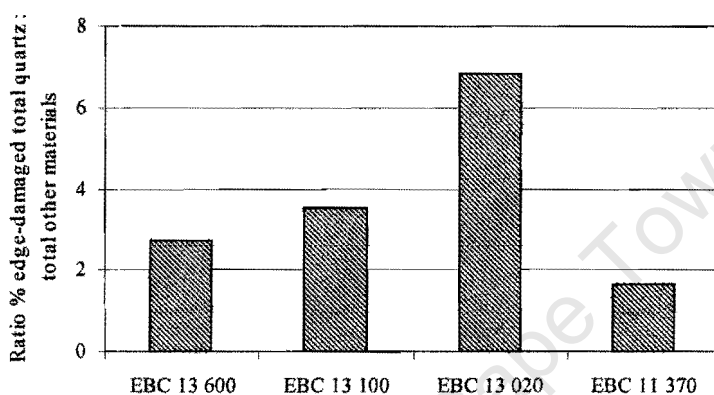


Figure 6.42 The ratio of the frequencies of edge-damaged pieces among all quartz artefacts to edge-damaged pieces among all artefacts in other materials in assemblages dating between 13 600 and 11 370 BP.

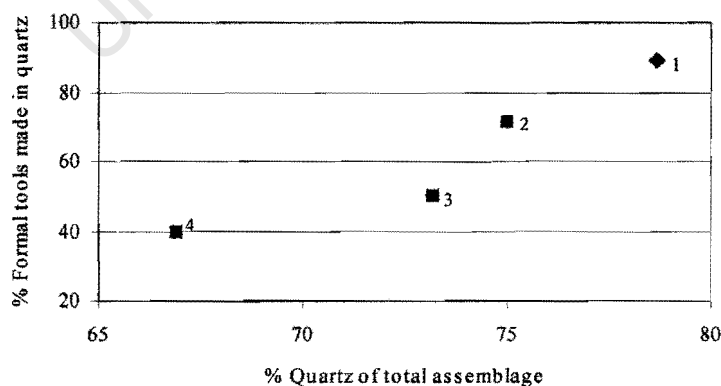


Figure 6.43 The relationship between quartz and formal tools made in quartz in assemblages dating between 13 600 and 11 370 BP.

The use of raw materials for formal tools is far more strongly patterned than is the case among edge-damaged pieces with a steadily increasing frequency of non-quartz flakes being retouched as time passed (Figure 6.44). This confirms not only the heightened interest in quartz during the late Pleistocene, but also the strategies of raw material conservation in operation through the late Pleistocene and early Holocene.

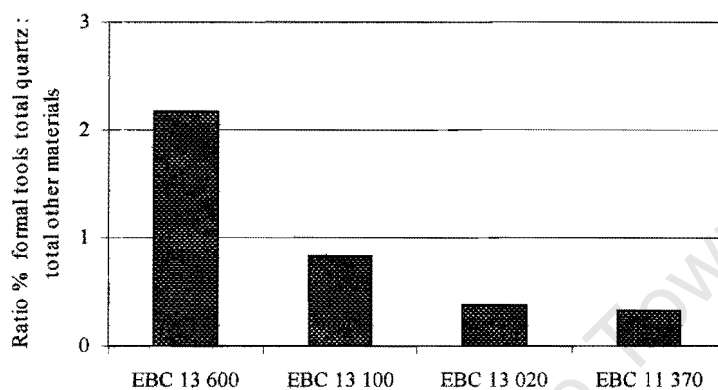


Figure 6.44. The ratio of the frequencies of formal tools among all quartz artefacts to formal tools among all artefacts in other materials in assemblages dating between 13 600 and 11 370 BP

Figure 6.45 shows that, especially just before about 13 000 BP, bipolar cores were relatively unimportant when compared with the post-1000 BP assemblages, when the ratio of bipolar to other cores generally ranges between 1.8 and 7 (Figure 6.3). The 13 600 BP assemblage, however, does display the highest ratio of bipolar cores to other types of cores, suggesting that the more truly 'Robberg-like' assemblages are more strongly comparable to those of the last thousand years.

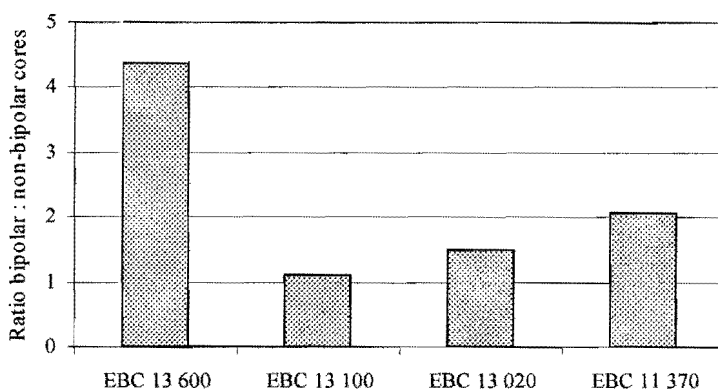


Figure 6.45 The ratio of bipolar cores to non-bipolar cores in assemblages dating between 13 600 and 11 370 BP.

It is possible that non-bipolar cores were further reduced via the bipolar technique in order to maximise the yield of each nodule of raw material. This may explain both the surprising absence of single platform bladelet cores, and the high frequency of bipolar cores in the 13 600 BP assemblage, and may be a factor in the low correlations achieved. Each of the two subsequent assemblages shows a fair proportion of single platform bladelet cores, but they are again absent at 11 370 BP (Figure 5.14). This situation is quite unlike the post-1000 BP assemblages in which bipolar cores relate far more strongly to blades than flakes, and single platform bladelet cores are entirely absent.

In common with the late Holocene bipolar core-rich assemblages, the late Pleistocene assemblages show a negative correlation between bipolar cores and chunks ($r = -0.763$; Figure 6.47), suggesting that fewer chunks, and hence more flakes (as shown above), were produced in assemblages dominated by bipolar cores. Non-bipolar cores also correlate negatively with chunks, however (Table 6.7), but this is probably a spurious correlation.

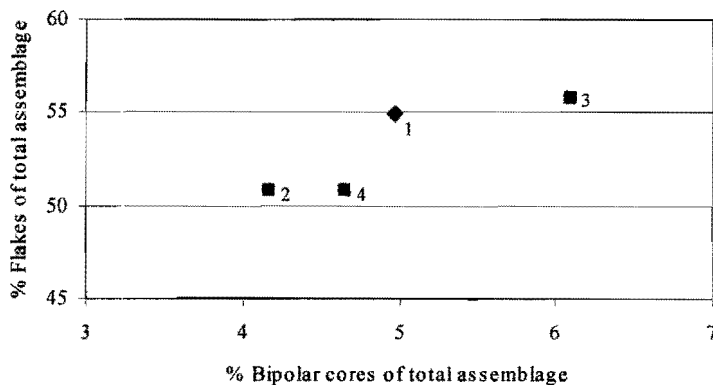


Figure 6.46 The relationship between bipolar cores and flakes in assemblages dating between 13 600 and 11 370 BP.

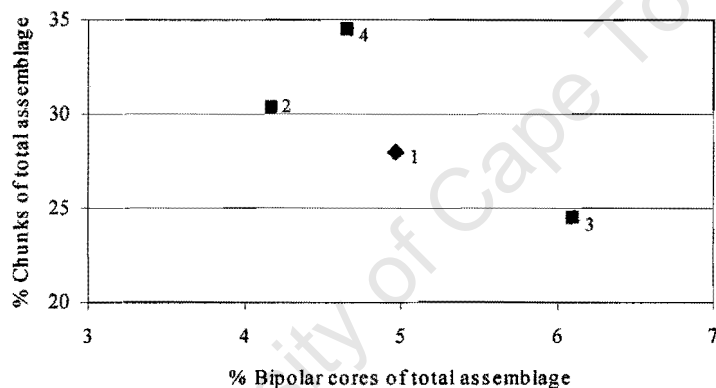


Figure 6.47 The relationship between bipolar cores and chunks in assemblages dating between 13 600 and 11 370 BP.

Fewer edge-damaged pieces are produced in strongly bipolar assemblages ($r = -0.798$; Figure 6.48), a feature shared by the assemblages from both other periods, and most likely explained in the same way. The positive correlation between edge-damaged pieces and non-bipolar cores, however, is not significant and best regarded as unlikely to be true, since flakes are shown to be related to bipolar cores (Figure 6.46).

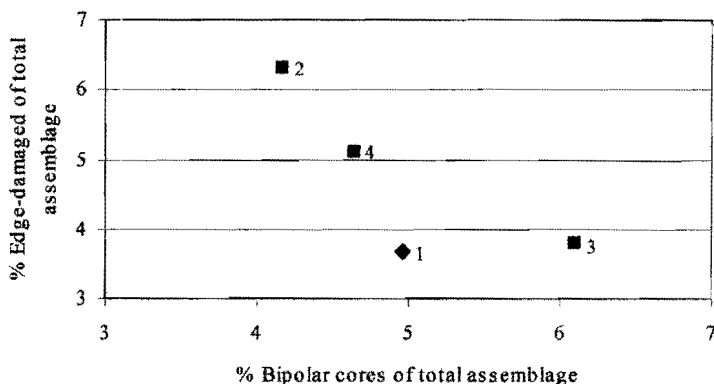


Figure 6.48 The relationship between bipolar cores and edge-damaged pieces in assemblages dating between 13 600 and 11 370 BP.

Bipolar cores correlate positively with formal tools ($r = 0.886$; Figure 6.49), as occurs during the late Holocene, suggesting that during both periods this technique was favoured for the production of blanks suitable for retouching. This correlation is undoubtedly related to the positive correlation between bipolar cores and flakes (Figure 6.46), since a high frequency of MRPs, which are more likely to be made on flakes, rather than blades or chunks, occurs at this time. A positive, but much weaker, correlation also exists between non-bipolar cores and formal tools (Table 6.7), and cannot be explained by the available data.

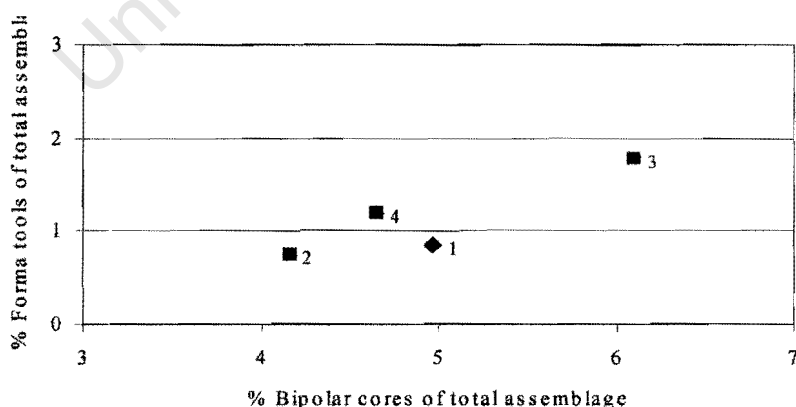


Figure 6.49 The relationship between bipolar cores and formal tools in assemblages dating between 13 600 and 11 370 BP.

With so few formal tools having been produced during this period, unmodified flakes and blades are likely to have been relatively important in the carrying out of day-to-day tasks. The ratio of formal tools to edge-damaged pieces shows no pattern for this period, other than that in all assemblages, unmodified artefacts are indeed relatively more important than the latter (Figure 6.50). When examined together with Figure 6.30, which plots the same ratio for the nonmicrolithic period, it is clear that edge-damaged pieces outnumber formal tools by at least 2:1 from 13 600 until about 9500 BP, after which retouched pieces gain in their importance. Similar proportions usually occur after 1000 BP, but three higher values of between 1.0 and 4.1 also exist, showing the greater variety evident at that time.

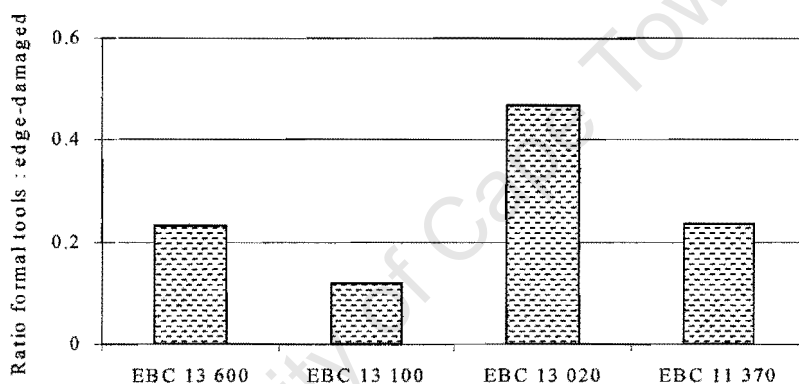


Figure 6.50 The ratio of formal tools to edge-damaged pieces in assemblages dating between 13 600 and 11 370 BP.

As in the terminal Pleistocene/early Holocene period, enough formal tools are present to allow some analysis. Figure 6.39 shows the overall formal tool composition by category. Only at 13 600 BP do backed tools comprise a significant proportion of the formal assemblage, while scrapers, despite being relatively infrequent, are consistent in their presence. It is the 'other' tool types, consisting largely of MRPs, that increase when the backed tools drop off. When the many MRPs are removed from the equation, a similar

pattern still emerges, although scrapers and backed tools become relatively more important, the latter especially so in the earliest assemblage, at 13 600 BP (Figure 6.52).

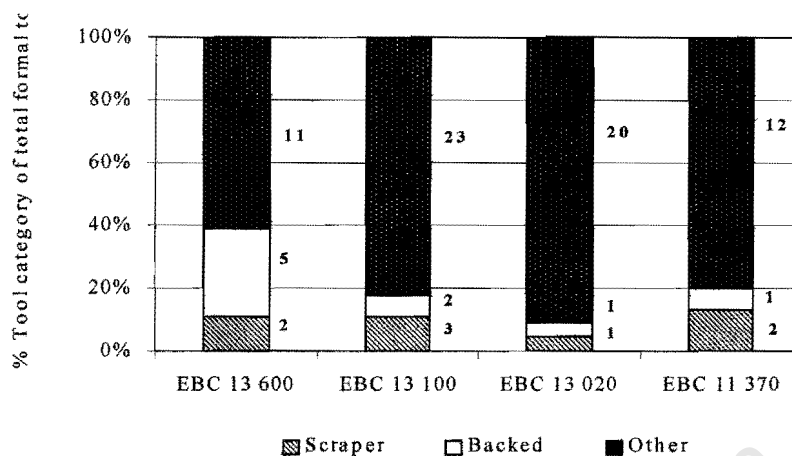


Figure 6.51 The formal tool composition of assemblages dating between 13 600 and 11 370 BP.

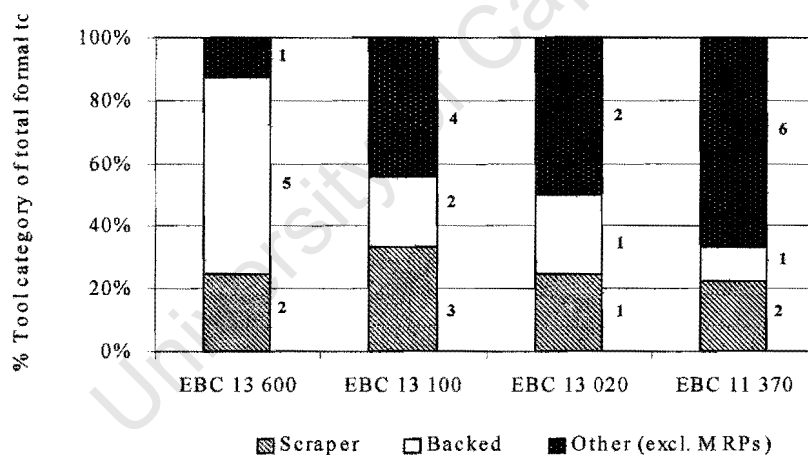


Figure 6.52 The formal tool composition with MRPs excluded of assemblages dating between 13 600 and 11 370 BP.

Total formal tool proportions at this time are typically low. In the current sample, with chips excluded, this figure varies between 0.8 and 1.8 %, with the smallest frequency occurring in the 13 600 BP assemblage (Figure 5.38). When chips are included, the range drops to between 0.4 and 1.4 %. These data compare favourably with the late Holocene assemblages,

in which, besides a single site with no formal tools and two with very high counts, the frequencies without chips range between 0.6 and 1.8 %.

Terminal Pleistocene assemblages frequently contain backed pieces, although scrapers usually still dominate (J. Deacon 1984b; Wadley 1993). In EBC, however, it seems that backed tools are at least equally, if not more important than scrapers (Figure 6.52). At 13 600 BP there is just a single miscellaneous backed piece (MBP), while in the remaining three assemblages, three of the four backed tools are MBPs. Although the number of backed tools is small, it still reflects the greater focus on the usually more standardised backed element at 13 600 BP, while in the same assemblage the low MBP frequency shows the stronger patterning among backed artefacts. Only two scrapers are present and patterning in the types of scrapers manufactured cannot be suggested. It is interesting that, in Figure 6.52, the remaining other tools – consisting of 11 adzes and 2 NBKs - still increase in frequency with time, as backed tools decline. Although only 11 adzes are present in these assemblages, the total artefact counts are high and the relative contribution of these tools to the totals is, therefore, likely to be significant. Table 6.8 shows the frequency of adzes in each of the four assemblages, demonstrating that these tools did indeed become more important towards the end of the Pleistocene. Curiously though, their frequency drops completely after 11 370 BP, with most nonmicrolithic assemblages containing no adzes at all (Figure 5.53). No obvious environmental reason is evident for this pattern (Section 2.2.3).

Table 6.8 Adze frequency during the late Pleistocene.

Assemblage	% Adzes
13 600 BP	0.05
13 100 BP	0.08
13 020 BP	0.16
11 370 BP	0.40

Figure 6.53 plots the frequency of retouch among the total quartz assemblage and that among all other materials. Clearly, increasing recognition was given to materials other than quartz after 13 100 BP, although when the nonmicrolithic period began, quartz was again more strongly favoured for retouch (Figure 6.33). The reason for this heightened concern with other materials at this time can be ascribed to the increasing importance of adzes, which are usually made in FGB rocks (Table 6.8) and MRPs, whose frequency in other materials increases over time (Figure 6.55 & 6.56 below). Interestingly, both adzes and total formal tools in other materials decrease after 11 370 BP.

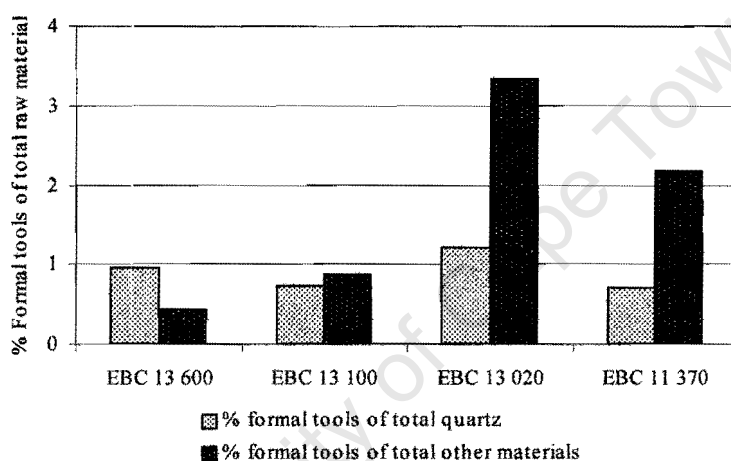


Figure 6.53 The frequencies of formal tools among all quartz artefacts and among all artefacts in other materials in assemblages dating between 13 600 and 11 370 BP.

Table 6.9 presents some tool frequencies by raw material. The final row shows that a smaller proportion of tools is present among the quartz assemblages (0.86%) than among all other materials combined (1.42%), showing that relatively more formal tools were made in other materials than in quartz, although Figure 6.53 shows this distribution to be uneven, with the earlier assemblages contributing relatively more quartz. Confirmation of the pattern outlined in Chapter 1, however, is still obtained.

Table 6.9 Cumulative formal tool frequencies by raw material in assemblages dating between 13 600 and 11 370 BP.

Tool Category	n (all raw materials) *	% made in quartz *	% of total quartz assemblage *	% of total all other materials *	n (all raw materials) **	% made in quartz **
Scrapers	8	100	0.13	0	20	95.0
Backed tools	9	77.8	0.11	0.09	18	66.7
Other (excl. MRPs)	13	15.4	0.03	0.52	30	33.3
Other (MRPs only)	53	67.9	0.58	0.80	156	79.5
Total	83	63.9	0.86	1.42	224	73.7

* Current sample

** Parkington & Yates (in prep. a)

Although the overall frequency of retouch among the quartz is lower than that among all other raw materials in three of the four assemblages (Figure 6.53), quartz was undoubtedly targeted for the manufacture of scrapers and backed tools. All 8 scrapers and 7 of the 9 backed tools are made in quartz (Table 6.9). The data from Parkington and Yates (in prep. a) included in Table 6.9, confirm the patterns obtained by my limited sample. In the first three assemblages, scrapers account for just over 0.1% of the quartz assemblage, while at 11 370 BP the figure rises to a little over 0.2%. This low frequency, in both quartz and other materials, continues into the succeeding transitional assemblages, increasing only at 10 000 BP for quartz, and 8900 BP for other materials (Figure 6.34).

Backed tools show a slightly different pattern to that demonstrated for scrapers. While quartz remains the focus, other materials (in this case only silcrete) are sometimes used (Table 6.9). There is a degree of variety, with one assemblage (13 020 BP) containing just a single backed tool made in silcrete, and the 13 600 BP assemblage containing five backed tools, all in

quartz. The latter situation corresponds well with the 950 BP to 570 BP assemblages in which just one backed tool is not in quartz. Late Pleistocene backed tool frequencies are low in all materials, with Figure 6.54 showing the variability described above.

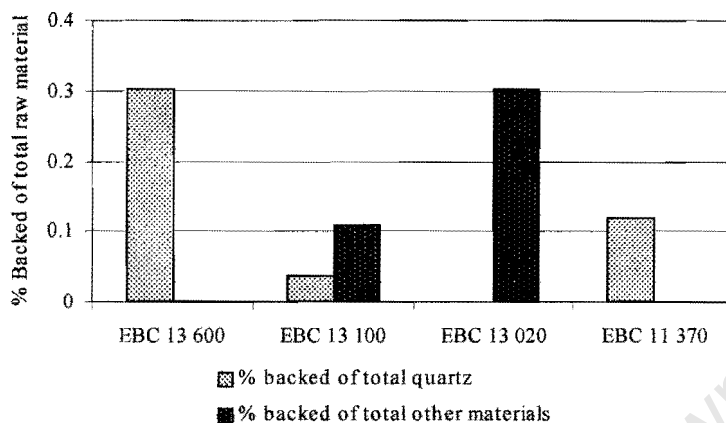


Figure 6.54 The frequencies of backed tools among all quartz artefacts and among all artefacts in other materials in assemblages dating between 13 600 and 11 370 BP.

Patterning among miscellaneous retouched pieces is similar in the late Pleistocene and late Holocene assemblages, although a degree of parity is only achieved when the large DFM 1 quartz assemblage is excluded from the calculations. MRPs account for some 63.9 % of all late Pleistocene formal tools, while in the late Holocene, the figure is 50% (excluding DFM 1). Table 6.9 shows that 67.9% of late Pleistocene MRPs are made in quartz, a situation quite comparable with the 75% (excluding DFM 1) from the late Holocene assemblages.

Figure 6.55 shows the frequency of MRPs in the total quartz assemblage and that in all the other materials. It is clear that in the two later assemblages, far more MRPs were made in materials other than quartz. This sudden increase both in MRPs and in the use of other materials is not readily explained.

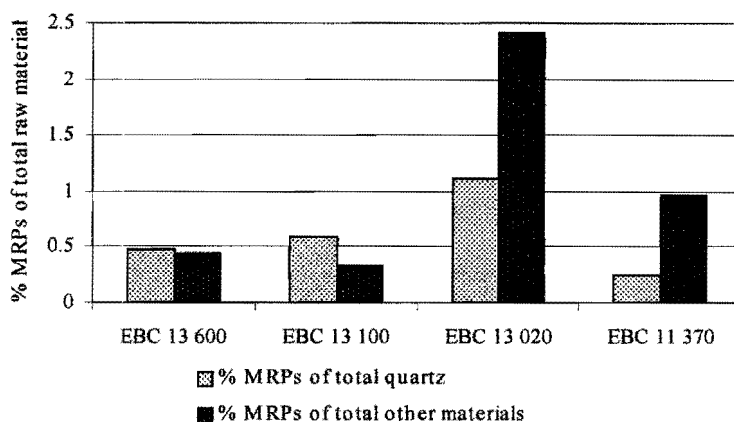


Figure 6.55 The frequencies of MRP's among all quartz artefacts and among all artefacts in other materials in assemblages dating between 13 600 and 11 370 BP.

Figure 6.56 shows the overall MRP frequency, with the proportional contribution of quartz and other materials indicated. When examined in conjunction with Figure 6.38, an odd distribution of MRPs is evident with two clear spikes. These can also be seen in Figure 5.54. One occurs during the late Pleistocene at 13 020 BP and the other is spread over four early Holocene assemblages from 9500 to 8800 BP. The latter undoubtedly contributes to the increase in total formal tool proportions mentioned above. Detailed studies of MRPs, beyond the scope of this research, would be required in order to uncover the reasons for this peculiar distribution.

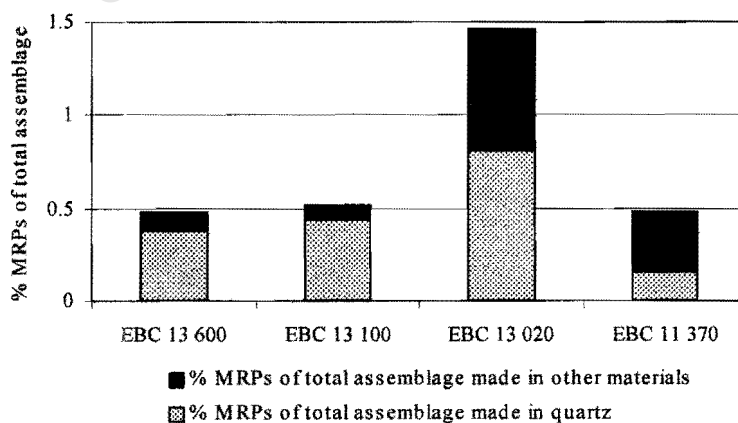


Figure 6.56 The frequency of MRPs in assemblages dating between 13 600 and 11 370 BP.

Unfortunately, with so few formal tools being present in the late Holocene assemblages, it is difficult to draw any reliable conclusions from comparisons of these and the late Pleistocene assemblages. A few comments can, however, be made. Both sets of assemblages show very low frequencies of scrapers and backed tools accompanied by high frequencies of MRPs. Other than the few NBKs found in the late Pleistocene, all the remaining tools in both periods are adzes, with eleven occurring in the late Pleistocene, and a further three in the late Holocene. The difference, however, lies in the higher frequency of adzes among both the formal tools and the total assemblages in the late Holocene, although it must be stressed again that these assemblages are small, with two of the three adzes being the only retouched artefacts in their particular assemblages. Although the 950 to 570 BP data are far from conclusive, similar patterns of raw material distribution among the formal tools seem likely to have been present during both this period and the late Holocene.

6.4.3 Summary and discussion

Although the late Pleistocene microlithic assemblages of Elands Bay Cave show high frequencies of quartz, this material is still more popular for flaking during the 950 to 570 BP period. This reflects the slightly greater diversity of raw materials used during the late Pleistocene, and possibly the wider movement of people at that time. In general, the late Holocene assemblages are more tightly focussed on the use of the bipolar technique for reducing stone, although indications from the 13 600 BP assemblage suggest that the makers of the more truly 'Robberg-like' assemblages may have also used this technique quite intensively but for different reasons. Soon afterwards, however, its use began dropping off rapidly. Interestingly, at 13 600 BP there does not appear to be an obvious source of bladelets, although single platform bladelet cores are present in succeeding assemblages. It is likely that, in an effort to conserve raw material, exhausted bladelet cores were struck further,

in a bipolar manner, thus maximising the yield of flakes from any nodule of stone. It is clear, however, from the direct correlation of quartz and blades, that the more quartz-rich assemblages yielded more blades than those in which quartz was used less. Despite the high incidence of bladelets usually found in late Pleistocene assemblages, production of flakes via the bipolar technique may still have been emphasised during the late Pleistocene, while at certain times after 1000 BP bladelets may have been the more desirable product of bipolar flaking, with no single platform bladelet cores being present at all. During both periods, the proportional frequencies of formal tools and bipolar cores suggest that blanks suitable for retouching were most commonly produced from these cores, while the frequency of tools made in quartz increases in direct proportion to the total amount of quartz flaked. The apparent relationship with bipolar cores may, however, be spurious, especially for the late Pleistocene, due to the possible recycling of cores mentioned above.

In the post-1000 BP sites, quartz-rich assemblages tend to have lower frequencies of edge-damaged pieces, but more of them made in quartz. No such relationship can be clearly demonstrated for the late Pleistocene, although there are hints that it may have existed then too. Formal tool frequencies are usually very low with edge-damaged pieces outnumbering them in both sets of assemblages, usually by at least 2:1. This suggests that more emphasis was placed on the use of unmodified flakes and blades than on retouched tools for performing daily tasks. With the variety in both sites and assemblages present after 1000 BP, however, some exceptions to this trend do occur at that time.

Although late Holocene assemblage sizes make such judgements unreliable, indications are that these late assemblages show similar raw material diversity among their formal tools. During the late Pleistocene, scrapers were almost always made in quartz, while backed tools

and MRPs were most often in quartz but with a small component of other materials represented. Interestingly, with the exception of the four NBKs, all other tools are adzes and these are almost always made in materials other than quartz.

Table 6.10 lists a variety of raw material and assemblage characteristics found in the assemblages of the two periods, and indicates their presence or absence in each.

Table 6.10 Summary of the comparison of late Pleistocene (13 600 – 11 370 BP) and late Holocene (950 – 570 BP) lithic assemblage characteristics.

Assemblage characteristic	Late Pleistocene	Late Holocene
Raw materials (quartz)	Dominant, especially at 13 600 BP	Dominant
Raw materials (others)	More variety than late Holocene, especially from 13 100 BP	Mostly quartzite
Cores	Less bipolar cores than late Holocene; but more at 13 600 BP, relationship to quartz not clearly demonstrated	Bipolar dominated, increasing as quartz increases
Blades	Regular production increasing as quartz increases	Sporadic production possibly related to quartz frequency
Edge-damaged pieces	Possibly similar pattern to late Holocene, but not clearly demonstrated	Decrease in frequency but more made in quartz as quartz increases
Formal : edge-damaged	Unmodified flakes more important than retouched tools, usually by about 2:1	Same as late Pleistocene
Formal tools (scrapers)	Rare, consistent presence	Rare, sporadic presence
Formal tools (backed)	Rare (except at 13 600 BP), consistent presence	Rare, sporadic presence
Formal tools (MRPs)	Very common, increasing with time and non-quartz materials	More frequent than other tools, sporadic presence
Formal tools (others)	Adzes – consistent presence but rare, increase with time and non-quartz materials NBKs – sporadic presence	Adzes - sporadic presence
Formal tool raw materials	Scrapers - almost always quartz Backed tools and MRPs - mostly quartz Other tools - mostly non-quartz	Unclear, possibly similar to late Pleistocene or slightly more variety

6.5 DISCUSSION: QUARTZ AND BIPOLAR FLAKING AT ELANDS BAY

Throughout the Later Stone Age at Elands Bay quartz has clearly been the most dominant raw material, while bipolar flaking has remained the most popular mode of reduction. Both factors have displayed much variation through time, however, and it is the reasons for this, along with the concomitant variation in other materials and flaking techniques, that are explored in this section. Although thus far discussed in inverse temporal order, I shall now revert to a chronological discussion, since comparisons are not the aim here, and this is the most logical way to present what has emerged as a gradually changing and developing set of lithic industries.

6.5.1 Raw materials

The extreme ascendancy of quartz over all other materials seems most logically to have been a result of its ubiquitous availability in the area around Elands Bay, a conclusion also reached by Manhire (1987) for sites in the Sandveld, immediately east and north-east of the current research area. The pebbles of the Piekenierskloof conglomerate (see cover photograph) would have afforded convenient access to a readily transportable source of raw material in relatively close proximity to their home bases or campsites. In other parts of southern Africa such as Lesotho and the Karoo area, if quartzite and sandstone are excluded, both the available and the utilised raw materials are dominated by cryptocrystalline silica and hornfels respectively (Mitchell 2002b). Similarly, near Plettenberg Bay, the sites of Nelson Bay Cave (J. Deacon 1984b) and Matjes River Rock Shelter (Döckel 1998) are both quartzite dominated, with the immediately local presence of this material, albeit in slightly different contexts in each case, being cited as having promoted its selection. Clearly people favoured the most easily accessible of the reasonable quality materials for the bulk of their lithic reduction. With quartz being the most readily available such material throughout most of the

Western and Northern Cape provinces it is therefore hardly surprising that such high frequencies of quartz are reflected in Table 1.1.

Quartzite and sandstone are undoubtedly the most freely available materials, but the physical structure of these rocks generally renders them unsuited to the manufacture of the tiny tools so characteristic of the LSA. We know that during the MSA, however, when larger artefacts were desired, such materials were widely used. As such the preference for quartz must also relate to its ability to produce small flakes.

As noted in Chapter 1, fine-grained materials such as silcrete and CCS were unquestionably prized for utilisation and retouch. At Elands Bay, especially prior to c. 8000 BP, FGB rocks were also highly valued. The Elands Bay sites reflect this pattern, with the proportions of edge-damaged (Figures 5.35 - 5.37) and formal tools (Figures 5.41 - 5.43) frequently exceeding 10% among these materials. Although the majority (60-80%) of tools are still made on quartz (Figure 5.39), the overall proportion of formal tools in the quartz assemblages only rarely exceeds 4% (Figure 5.40). Although technically a coarse-grained rock, the crystal structure of quartz still allows relatively fine working. It is clear, however, that fine-grained materials must have been difficult to obtain, but when at hand, they were preferentially used.

Late Pleistocene microlithic assemblages are present between 13 600 and 11 370 BP at EBC, although only the oldest one shows relatively close affinities with the industry termed 'Robberg' elsewhere in southern Africa. While the overall proportion of quartz is not as high as during the late Holocene, a neat trend in which quartz frequencies decline steadily is plainly visible (Figure 5.3). The corresponding decline in the frequency of quartz chips is not as clean (Figure 5.55), and, sorting problems aside, is assumed to have been influenced by

both the reduction in quartz use over time and the increase in stone knapping skills. Related to this, however, is the fact that late Pleistocene assemblages, most notably that from 13 600 BP, were rather expedient in their manufacture and that as this expedience decreased, so too did the frequency of chips as less material was wasted.

While MacDonald's (1991) suggestion that raw materials will be more varied in short-term occupation sites than long-term ones does not work for the late Holocene quartz-rich sites, it may be seen to apply to the late Pleistocene occupations of EBC. Parkington and Yates (in prep, a) consider this period to have witnessed sporadic, but long-term occupations, and the expedient nature of the lithic assemblages supports this conclusion to some degree. Assuming MacDonald's theory to fit EBC at 13 600 BP, people may have been fairly restricted in their movements while in residence in the cave, possibly for reasons of climatic unsuitability related to the ongoing demise of the LGM. Gradually, as the climate ameliorated, they would have begun foraging further and more frequently, encouraged by the approaching coastline. Burgeoning shell middens in EBC between 11 000 and 9000 BP (Parkington 1988, in prep. c) testify to frequent trips to the coast, which would have still been some 3 to 5 km away (Poggenpoel 1987). This greater mobility would have promoted the increased sourcing and collection of non-local raw materials, perhaps especially those available only in river gravels, than had been possible before.

The desire for many tiny bladelets during the earlier millennia of this period may have reduced the need to seek alternative raw materials, since these artefacts were clearly produced perfectly adequately on quartz, and the two factors decrease coincidentally at this time. As the interest in quartz drops off, quartzite once more assumes a steady increase along with most other materials (Figures 5.4 & 5.5). The increase and subsequent decrease of silcrete

(Figure 5.6) may reflect the lack of mobility at 13 600 BP, the increase in mobility at 13 100 BP, and finally the loss of interest in this material leading into the nonmicrolithic period as larger artefacts were more commonly produced. Parkington and Yates (in prep. a) have suggested that the drowned Pleistocene landscape off the current coast may have been a considerable source of silcrete. If this was the case, however, the relative consistency of the frequencies in Figure 5.6 shows that this source would have been largely ignored.

During the terminal Pleistocene/early Holocene period quartz is flaked less than at any other time during the Elands Bay LSA, with the lowest overall quartz frequencies (less than 60%) being present between 10 550 and 9650 BP. This period corresponds with that commonly known either as the 'Oakhurst' or 'Albany', and is best defined at EBC by the combination of the lower incidence of bladelets from 10 000 BP (Figure 5.27) and the lower quartz frequencies and corresponding increases in other materials between 10 000 BP and 8900 BP (Figure 5.3). Although the range of raw materials employed at this time is fairly wide, the materials that replace quartz are mainly local with quartzite and sandstone comprising the majority (Figures 5.4 & 5.8). The reasons for this raw material switch are not so straightforward, and with quartz receiving continued preference, among both edge-damaged pieces and formal tools, a strategy of conservation of quartz was quite likely in operation.

MacDonald (1991) has suggested that where raw material sources are located far from the site, greater raw material variability among the lithics might indicate greater mobility and shorter occupation times. It is difficult to know where materials falling in the 'other' and FGB rock categories were sourced, especially with the variability contained in the Piekemierskloof conglomerates (see cover photograph), although prior to the mid-Holocene siltation of the Verlorenvlei, pebbles of various rocks might have been available in the river

bed. With the knowledge that at least some Karoo hornfels, in the form of NBKs, is included in the FGB rock category (Parkington, pers. comm.), we may well be able to suggest greater mobility prior to about 8500 BP when NBKs disappear from the sequence. In the light of the non-lithic evidence, however, MacDonald's shorter occupation periods are not sustainable. The presence of burials in EBC from 11 000 BP coupled with a dramatic diversification of activities and remains from this time onwards suggest longer terms of occupation, and perhaps even home base status for the site (Parkington 1998). A consideration of the available evidence led Parkington and Yates (in prep. a) to suggest that after c. 9000 BP mobility once more increased with shorter occupations occurring.

In the light of the fact that nodule size may not have been the only factor driving the selection of non-quartz materials, consideration needs to be given to other reasons for their prominence at this time. Silcrete and CCS proportions are low (Figures 5.6 & 5.7), with FGB rocks and 'other' being inflated (Figures 5.10 & 5.11). If the latter two were available in river gravels, as seems likely, then this may have been the reason for their relatively greater showing at this time. The reasons for the overall reduction in quartz use is less easily understood. Two possible scenarios can be suggested:

- 1) A concerted effort may have been made to select rocks that would allow the production of larger flakes. This seems unlikely to have been a major force since, as already noted, the artefacts are only slightly larger than those produced at other times, and formal tools and edge-damaged pieces are still preferentially manufactured on quartz (Figures 5.31, 5.39, 6.23 & 6.26). It may be, however, that the coarser-grained materials, such as quartzite and sandstone, although seldom retouched, may have been used more frequently for other things. The coarser grain size of these materials might reduce scarring and make

detection of use more difficult during analysis. In addition, we have no way of knowing what size blocks of quartz were available to people at that time, although substantial quartz veins are uncommon in the western Cape (Parkington & Yates, in prep, a).

- 2) Perhaps a more plausible scenario would see quartz being conserved with a conscious attempt being made to use more of the other rock types for tasks not requiring high quality edges. This would explain the higher frequency of retouch and edge-damage among the quartz assemblages than among all other materials. If this occurred, then an increase in the skill of the stoneworkers may be implied, since they would have to have been able to service their needs in terms of blanks suitable for retouch or utilisation, while wasting less of their preferred raw material. This is well reflected in the increased frequency of quartz edge-damaged pieces between 10 000 and 8900 BP (Figure 5.32). Formal tools, however, only show a corresponding increase in the latter half of this period. The reduction in the frequency of chips (i.e. wasted, unusable stone, Figure 5.55) immediately following the end of the late Pleistocene microlithic period is quite likely related to the concomitant reduction in bipolar flaking, and also suggests an increase in knapping skills.

During the late Holocene the low incidence of sheep bones at each site included in this study suggests that all were occupied by hunter-gatherers rather than herders, although the ideas of Sadr *et al.* (2003) suggest that this sort of distinction is by no means conclusive. With the vegetation of the Sandveld being far more attractive to larger animals than that of the mountainous areas (Moll 1986), it is thought that hunter-gatherers were forced out of the open Sandveld and into the more rocky and mountainous areas of the Western Cape as a direct result of the beginnings of pastoralism (Parkington *et al.* 1986; Manhire 1987;

Parkington 1987). If this was indeed the case, then it is likely that their gathering and hunting forays would also have been considerably curtailed. Silcrete, a material primarily available in the Sandveld to the north of Elands Bay, may then have become more difficult to access, while quartz and quartzite, which are readily available in the local mountains, became even more frequently used. Quartz frequencies are particularly high, averaging just over 86%, with most other materials present in the assemblages quite likely to have been collected opportunistically when they happened to be seen during the daily round. Examination of Figure 5.6 shows that silcrete consistently comprised about 4% or more of the total assemblages at all sites prior to 2000 BP suggesting that access to this material had been consistent and uninterrupted, perhaps inhibited only by its distance from Elands Bay. After this time, when pottery and sheep bones are regularly found, silcrete only features strongly at one site - EBC. Tortoise Cave shows a similar drop in silcrete use after 2000 BP (Robey 1987, Table 3), lending further support to the pattern. Interestingly, despite being far nearer the potential sources of silcrete, Steenbokfontein Cave (Figure 2.2) shows similarly low proportions of silcrete before 2000 BP (Jerardino & Yates 1996, Table 7), possibly suggesting that this material was generally difficult to find and access in this part of the western Cape.

The relatively strong showing of silcrete in all six post-2000 BP assemblages from EBC (and in fact all EBC assemblages back to 8000 BP) suggests that its occupants always had access to this material, thus implying a wider catchment area for this site than any other. Various explanations for this post-2000 BP high silcrete frequency at EBC can be proposed.

- 1) The most plausible explanation revolves around the fact that EBC, being larger than the other sites, is likely to have seen far longer occupations. As such, its occupants would

quite likely have engaged in far wider foraging rounds, providing greater opportunity to locate and collect silcrete. EBC might even have been an aggregation site at this time, with people able to bring stone from further afield. Wadley (1987) considers aggregation sites to contain a more varied set of raw materials and tool types, although at EBC, only the raw materials seem to fit her aggregation pattern.

- 2) Another view would see the post-2000 BP occupants of EBC having permanent contact with pastoralists who may have sourced and collected the silcrete, perhaps trading it for wild animals hunted in the rocky hills of Bobbejaansberg.
- 3) A third, but somewhat less likely scenario would see the cave being occupied by pastoralists, with the small, outlying sites being those of hunter-gatherers. The limited sheep remains from the large EBC excavation, however, serve to negate this suggestion.
- 4) A final possibility is that silcrete, as a highly prized raw material, may have been associated in some way with ritual activities at EBC (Smith, pers. comm.). The cave contains many handprints, which are thought to relate to initiation rituals, and to date within the last 1900 to 1600 years (Anderson 1997; Manhire 1998). This coincidental occurrence of silcrete and handprints may, therefore, be significant. An alternative ritual significance as suggested by Hall (2000:143) is that silcrete might have been “an identity marker that may have tied people to the power of specific places where silcrete was quarried”. Unfortunately, neither theory can be tested.

Despite the high frequency of quartz during the late Holocene, this material still shows some variability and appears to covary most strongly with quartzite. The latter rock comprises

between 5% and 10% of most assemblages, and is the second most commonly used material. The infrequent occurrence of most other materials makes it difficult to detect patterns in their use.

Humphreys (1972, Figure 1) illustrates the change from distant to local raw materials at sites documented by Sampson (1967a, b, 1970; Sampson & Sampson 1967) along the Orange River. A trend, in which local materials become more frequently used in recent millennia, is apparent. Sampson (1970) and Humphreys (1972) suggest that the distance to source (and hence difficulty of access) may have been the deciding factor in the slide in CCS use. Humphreys (1972) offers the interpretation that people simply became more aware of hornfels (lydianite) over time, but I suspect that increasing population density and accompanying territoriality may have also played a role. It is possible that the considerable drop in the use of materials other than quartz and quartzite at Elands Bay after 1000 BP may also have been for territorial reasons, with more localised foraging resulting in more limited access to such materials. This would need to be tested on a wider scale than the current research allows.

6.5.2 Technology

Bipolar reduction of quartz dominates the Elands Bay LSA. Three related factors promote bipolar flaking of quartz:

- (1) Pebbles have no natural striking platforms, and with quartz being most commonly found in this form, the bipolar technique is the most logical way of reducing them. Of course it is likely that with larger pebbles, the initial bipolar strike may produce fragments that might be worked in other ways.

- (2) Due to its pebble occurrence, it is seldom possible to find quartz nodules large enough to allow non-bipolar flaking. The mass of the original quartz nodule, as suggested by Dickson (1977), needs to be about 60 grams or more in order for direct freehand percussion to be possible.
- (3) Quartz, due to its crystal structure, is a tough, unpredictable material that does not always flake readily by direct freehand percussion. The bipolar technique is the most obvious way of working this material, although even in this manner flakes are frequently only produced in low proportions (see experiments contained in Appendix 1). Those flakes that are produced are often small and unusable such that only a very small number of good, useful flakes might be generated per bipolar core. It may have been recognised by prehistoric stoneworkers that any non-bipolar techniques of quartz flaking were rather ineffective, and that it was simply better to use the bipolar technique, hope for the best, and if good flakes were not obtained then try again with another nodule. In the presence of reliable sources of quartz, this sort of strategy can be sustained. It is thought that the likelihood of producing reasonable flakes can be improved by wrapping the cores in bark, leather or some other material (J. Deacon 1984b). This causes the force of the hammer blow to be propagated further down the side of the core, with the result that longer flakes are produced. This technique has also been recorded in New Guinea where a bark wrapping around a bipolar core is said to produce “relatively longer, thinner and smaller flakes, which are kept neatly together by the bark wrapping and are not scattered around by the flaking process” (White & Thomas 1972:278). Through the experience of bipolar experimentation, however, I feel that this technique is unlikely to have been used where quartz was flaked expediently. Cores would have to be unwrapped and rewrapped after each hammer strike in order to ensure that any flakes or bladelets produced were not

destroyed by subsequent strikes. This process is time-consuming, and where quartz was clearly easily available, is unlikely to have been practised.

Despite these factors, no correlation is evident between quartz and bipolar cores when all Elands Bay assemblages are considered together ($r = 0.130$; $T = 0.839 > t_{41}$ at the 50% level). This is surprising and not readily explained. As already noted for DFM 1 (Orton 2002), the very small size of most single platform and irregular cores would suggest that these too may have been worked on an anvil. This unrecognised ‘bipolar flaking’, along with the contribution of some small assemblages and sampling bias, may account for some, but certainly not all, of the lack of correlation indicated above. Table 6.11, however, still shows that, overall, the bipolar technique was certainly favoured for quartz reduction.

Table 6.11 Frequencies of core types per raw material (all assemblages combined).

Raw Material	Bipolar	Single Platform	Single platform bladelet	Irregular	Total
Quartz	69.7	9.4	2.0	18.8	99.9
Quartzite	23.1	26.9	-	50.0	100
Silcrete	16.5	23.5	22.4	37.7	100.1
CCS	27.3	15.2	21.2	36.4	100.1
Sandstone	-	14.3	-	85.7	100
FGB rocks	38.9	16.7	-	44.4	100
‘Other’	29.4	5.9	-	64.7	100

Other raw materials, despite still showing some bipolar working, are far more heavily weighted towards irregular and single platform core varieties (Table 6.11), thus demonstrating their higher degree of ‘workability’ compared to quartz. It is interesting that the FGB rocks display the next highest proportion of bipolar cores. This suggests that a fair proportion of these rocks were obtained in small pebble form, a reasonable conclusion,

considering that local sources for these rocks at Elands Bay are unlikely to take any other form. The high frequency of irregular cores in sandstone and quartzite betrays the fact that these are local materials easily available in larger blocks, while that for 'other' is perhaps higher than expected, since pebbles are also assumed to be the source of most rocks included in this category. The majority of irregular cores in both 'other' and the FGB rocks come from the 11 050 BP to 8500 BP period, suggesting that larger blocks of material were obtained at that time, and supporting the notion that people had increased access to these raw materials. With the difficulty in recognising hornfels in hand specimen, and the knowledge that this material does exist at EBC (Parkington, pers. comm.), it is possible that some of the irregular cores in the FGB rocks might be hornfels, which occurs in unlimited size in the dykes of the Karoo.

The contribution of single platform bladelet cores to the silcrete and CCS core data (Table 6.11) show that it is these materials that are most predictable in their flaking and can be more readily used in a standardised flaking technique requiring a core to be set up and shaped before usable bladelets can be removed. The existence of these cores in quartz, silcrete and CCS shows that it is only from these three materials that bladelets were principally desired and most easily produced. In addition, the discrepancy between the latter two materials in terms of bipolar and single platform cores probably reflects the fact that CCS is more likely found in pebble form, and that silcrete, which consists of both matrix and inclusions, is slightly softer on average and thus more easily flaked via non-bipolar means than CCS.

Altogether, due to the high overall proportion of quartz, most attention was given to bipolar flaking, with this technique accounting for 65.45% of all cores. Bipolar flaking seems to have been used to produce both flakes and bladelets, as well as the majority of blanks

selected for retouch, although in the earlier periods it was quite likely only employed after other flaking techniques.

Due to the scarcity of materials suitable for blade and bladelet production, these artefacts are generally rather uncommon in Elands Bay assemblages. In areas such as Lesotho, where CCS dominates the raw materials, far higher frequencies of blades and bladelets are obtained (e.g. Carter *et al.* 1988), while to the immediate south-east of Elands Bay, Scorpion Shelter (Figure 2.2; Wahl 1994) has higher frequencies of both silcrete and bladelets than occur in any of the Elands Bay sites. Nelson Bay Cave, on the Cape south coast (Figure 2.1), contains an unusually high proportion of quartzite and concomitantly low bladelet frequencies, although in the single unit in which silcrete is fairly common (YSL, dated to c. 16 700 BP), the highest bladelet frequency is also achieved (J. Deacon 1984b). These examples further demonstrate the necessity of having access to good quality, fine-grained materials if bladelets are to be produced in any great number.

As with all assemblages, the main lithic classes, flakes and chunks (and chips which are not included here) dominate the assemblages. Overall, flakes are usually more numerous than chunks in all raw materials (Table 6.12), with variations being due to a combination of reduction technique and physical properties of each type of rock. Non-bipolar flaking (in the case of quartzite, silcrete and CCS) and higher quality material (in the case of silcrete, CCS and FGB rocks) will result in greater frequencies of flakes. Quartz, with its poor fracture qualities and necessity of being worked in a bipolar manner, shows a low incidence of flakes to chunks, although this is not reflected in the bipolar experiments (Appendix 1), and may be due to poorer quality quartz at Elands Bay than was used in the experiments. Interestingly, Figure 5.26 shows that, through time, fewer quartz flakes were produced relative to chunks.

This may be a result of the increasing informality which arises as patterned toolmaking behaviour decreases or might reflect the fact that reasonable quality quartz became more and more difficult to find as sources were used up over the millennia.

Table 6.12 Flake to chunk ratio per raw material (all assemblages combined).

Raw Material	Flake : Chunk
Quartz	1.14
Quartzite	2.16
Silcrete	1.99
CCS	2.37
Sandstone	1.23
FGB rocks	2.37
'Other'	1.18

Table 6.13 shows the cumulative total proportion of edge-damaged pieces and formal tools among each raw material. It is quite clear that when available, silcrete, CCS and FGB rocks are preferred for these artefacts. Their low overall incidence, however, means that the high frequencies indicated here have little effect on the total proportion of non-quartz materials among formal tools and edge-damaged pieces as shown in Sections 6.2 to 6.4. Due to their physical properties, the coarser-grained quartzite and sandstone are seldom used while the somewhat intermediate values for 'other' indicate the mixture of rock types contained in this grouping. Quartz, while being a very popular material for flaking, also shows intermediate values. This is probably partly due to the fact that when flaked, quartz produces a higher proportion of chunks than other materials, such that the number of blanks suitable for retouching or use is considerably reduced.

Table 6.13 Frequencies of edge-damaged pieces and formal tools per raw material (all assemblages combined).

Raw Material	Edge-damaged	Formal tools
Quartz	3.2	2.5
Quartzite	1.1	0.8
Silcrete	9.7	5.7
CCS	8.4	5.9
Sandstone	0.7	0.3
FGB rocks	9.3	4.4
'Other'	3.3	1.0

The late Pleistocene microlithic period, despite having a generally bipolar character, has only 66.2 % quartz bipolar cores. At 13 600 BP they are most common, with the rapidly declining proportion thereafter indicating a move away from this method of reduction and a change in the approach to the conservation of quartz. Other raw materials are preferentially worked in a non-bipolar manner, with only 16.1% of cores being bipolar. The punch technique described by H. Deacon (1995) as having been used to produce Robberg bladelets is not evident at Elands Bay, with the dominant raw material, quartz, being unsuited to its use.

In all materials, late Pleistocene non-bipolar cores are fairly evenly split between single platform and irregular types, perhaps suggesting a slightly more strongly patterned behaviour in the reduction of stone than was present during the later nonmicrolithic period during which irregular cores are more frequent. This is also indicated by the far higher incidence of single platform bladelet cores in the earlier set of assemblages. Proportionally, if one compares the microlithic with the succeeding nonmicrolithic period, the decrease in single platform bladelet cores is far greater than that in bladelets, showing that more of the bladelets were produced via other means during the later period, and that greater emphasis was placed on the standardised single platform bladelet cores during the earlier period. Single platform bladelet

cores are not strongly evident at 13 600 BP when we might expect them to be at their highest. As discussed before, this is probably due to recycling of cores which would account for both the very high bipolar frequency, as well as the few single platform bladelet cores.

We know that, at least in other parts of South Africa, the late Pleistocene microlithic industry was heavily focussed on the production of small bladelets. These are thought to have been very versatile artefacts, although utilisation scars are typically uncommon (Mitchell 2002b). Their use on a variety of materials at Sehonghong has been demonstrated by microwear studies (Binneman & Mitchell 1997). At EBC, however, the frequency of edge-damaged pieces is somewhat higher than that found elsewhere. This may be related to the significantly lower frequency of bladelets than in some other areas of southern Africa. The lower frequency of these artefacts at EBC may have resulted in both flakes and bladelets being used in different ways, such that they were more likely to be damaged, or they might have been more intensively used and less frequently replaced. Edge-damaged artefacts are more frequent than retouched pieces, suggesting that during the late Pleistocene little emphasis was placed on retouch at all, with people being content to make use of unmodified flakes and bladelets instead.

Formal tools are generally infrequent and are known to be less standardised in size and form at this time than during later millennia (Mitchell 2002b). Those from Elands Bay Cave are no exception with a high proportion of MRPs and many of the remaining tools being miscellaneous scrapers or backed pieces.

The technology of the terminal Pleistocene and early Holocene nonmicrolithic period is quite different to that which came before or followed afterwards. It is united by a series of

interlinking factors that contrast with the characteristics of earlier and later periods of the LSA. The pattern is not unique to this area, but is part of the nonmicrolithic trend that was widespread across southern Africa between approximately 12 000 BP and 8000 BP.

Many flaked artefacts, but specifically formal tools, were slightly larger than at other times, suggesting that the biggest flakes were actively selected for retouch. It is likely that, to some extent, the desire for larger artefacts drove the selection of raw materials, both in terms of type and size, as well as the flaking techniques employed in their reduction, although as explained earlier, it may also have been due to the need to conserve quartz. At this time quartz and bipolar cores co-incidentally reach their lowest levels, suggesting that the bipolar flaking of quartz was not particularly likely to produce larger flakes and was not the focus of the industry. Of course, this technique was probably used less to avoid unnecessary wastage of stone. As a result, materials more commonly found in larger nodules or blocks prevail, and non-bipolar methods are more commonly used. Bipolar flaking is, however, still recognised as the easiest means of breaking up small or left over lumps of quartz, since 62.8% of all quartz cores from this period are bipolar. All other materials, except CCS which has very few cores, show bipolar cores to be in the minority, with the combined frequency of these cores in all other materials totalling 29.8%. Only silcrete shows an even split between single platform and irregular cores, with all other materials showing the latter to be far more common. This may be a result of the types of flakes that were desired. Irregular cores may have more reliably produced the wider flakes that would have been sought for the larger scrapers made at that time. It is unfortunate that, especially with quartz, it is seldom possible to tell from what type of core a blank was produced, since with 75.4% of formal tools still being made on quartz, it is likely that some of the blanks may have been produced via the bipolar technique. Blades too may have been produced by bipolar flaking, since both

decrease through time such that flakes become far more popular both overall and for retouching.

As a result of the extreme dominance of quartz during the late Holocene (950 to 570 BP), the choice of flaking technique is particularly limited, with bipolar reduction being more extensively practised at this time than any other (Figure 5.14). Bipolar cores account for 94.6% of all cores from this period. It seems likely that the use of the bipolar technique was determined by the constraints placed upon the toolmakers by their raw materials, rather than by any other factor. With so few non-bipolar cores present in the assemblages of this time, it is quite clear that the bipolar technique was used in the production of almost all flakes and blades. All the other materials together show a near absence of bipolar cores with a fairly even split between single platform and irregular cores. Most of these cores are in quartzite, however, and it is not possible to make further judgements on how different materials were treated.

The quality and sharpness of the edge that can be produced on quartz was clearly recognised by the late Holocene toolmakers, since those assemblages with high frequencies of quartz show more edge-damaged pieces made in quartz but fewer overall. This certainly suggests that the edges on quartz flakes needed less frequent replacement. A similar pattern, albeit in slightly weaker form, is evident during the non-microlithic period.

With the exception of one site, DFM 1, formal tools are remarkably uncommon in Elands Bay at this time, and as such, little can be said of them. With so many bladelet-based formal tools and such a high proportion of bipolar cores at DFM 1, it is quite clear that the good quality crystal quartz used at that site allowed the toolmakers to produce significant numbers

of blade and flake blanks, which were either used as is or after the application of backing to one edge. At no other site was crystal quartz as frequently used and the difference in raw material quality may have been one of the factors contributing to the generally low frequency of retouch at all other sites. It is clear though, that this is only one such factor, with others undoubtedly making a contribution. The opposite view may also be possible: since formal tools were not required in any great number, little need for high quality stone was experienced. If the latter is applicable, it would imply that the stone workers from DFM 1 deliberately sought out the higher quality crystal quartz with which they made their tools.

6.5.3 Summary

General qualities of the Elands Bay LSA lithics

Due to its accessibility, transportability and ubiquitous occurrence, quartz strongly dominates all aspects of the LSA lithic assemblages from the Elands Bay area. Quartzite is the only other widely available raw material of reasonable quality but quartz, with its ability to produce small flakes, and with the right technique, bladelets, is favoured for artefact production. On the occasions when fine-grained siliceous materials such as silcrete, CCS and the FGB rocks were obtained, they were put to maximum use with a high degree of retouch and edge-damage evident on both materials.

As a result of the quartz domination, the bipolar technique is the primary mode of reduction employed throughout the Elands Bay LSA. This choice appears to have been based on the small size of the available chunks and pebbles, the lack of natural striking platforms on the latter, the toughness and unpredictability of the rock when struck, and its ability to produce flakes from very small cores. The greater 'workability' of all other materials is demonstrated by the fact that other core types are far more common in these materials. The high

frequencies of single platform bladelet cores in silcrete and CCS indicate that these materials are the best available in the area. The low frequencies of blades is most likely due to the general lack of high quality materials in Elands Bay. In general, the steady decline in the quartz flake : chunk ratio suggests that there was a loss of skill in stone working over time.

Late Pleistocene microlithic assemblages

While quartz dominates most strongly during the earliest assemblage of this period, its use declines steadily towards the start of the Holocene. A corresponding increase in all other materials is noted. While expedience decreased, an increase in stone knapping skills leading into the early Holocene may be implied by the lithics.

Bipolar flaking is most commonly used on quartz but its use drops steadily. Other materials are mostly worked in non-bipolar ways. The higher frequencies of single platform cores, and especially the bladelet variety, suggest a more standardised and patterned approach to lithic reduction than in later millennia, although efforts at maximising flake production led to the reversion to bipolar flaking when cores became too small. This explains the high frequency of bipolar cores in quartz, such that their extreme dominance at 13 600 BP may be artificial. Formal tools are infrequent and unstandardised, with edge-damaged pieces being far more common.

Terminal Pleistocene/early Holocene nonmicrolithic assemblages

The domination of quartz is less strong than at other times, with local materials making up most of the difference. A greater interest in various other non-local materials also existed, with raw material selection possibly being influenced by the desire for larger flakes and the

need to use quartz more sparingly than before. While quartz was seemingly used less than during earlier millennia, it was used more efficiently.

Many artefacts, but especially formal tools, are larger than at other times, with the biggest flakes having been actively selected for retouch. While quartz is less common, the bipolar technique is still recognised as the best means of reducing it. The fact that irregular cores dominate materials other than quartz suggests that this mode of reduction may be optimal for the production of larger flakes. While other materials often display edge-damage, the quality of quartz edges was increasingly recognised.

Late Holocene assemblages

At this time people were very limited to the use of local rocks such as quartz and quartzite with the former dominating very strongly. Other rocks were occasionally, and perhaps opportunistically, collected. This pattern may be due to the short terms of occupation and the limited need for stone tools at the smaller sites, since EBC, the one site likely to have seen longer occupations, is the only exception.

Bipolar flaking is by far the preferred means of reduction of quartz, with the small number of other cores suggesting that this technique was adequate to serve all their needs at this time. Since other materials are treated differently, it seems that the choice of the bipolar technique was based primarily on raw material properties. The high quality of quartz edges was recognised with this material showing the most frequent edge-damage. Formal tools are generally very infrequent.

7 THE PATTERNS IN CONTEXT

In this chapter, the Elands Bay data are placed in a wider context which aids and expands on the interpretation of the patterns revealed in Chapter 6. Due to the extreme dominance of quartz and bipolar cores, and the consequent reduction in variation apparent in most Elands Bay assemblages, the local patterns can be difficult to interpret. When examined alongside a far more variable group of assemblages, however, certain traits begin to stand out. This group of assemblages is drawn from other parts of the Western and Northern Cape Provinces, with many being assemblages analysed by myself. As such, they are directly comparable with those from Elands Bay. This comparison will allow the general patterns to be explored at both the local and regional levels. In addition, it is possible to tell whether the observed trends are restricted to the Elands Bay area, restricted to sites rich in quartz or might be applicable to all Later Stone Age lithic assemblages. The data to be compared are presented in tables with each site added for comparative purposes printed in bold type. The geographic locations of these latter sites can be seen in Figures 1.1, 2.1 and 2.2.

7.1 RAW MATERIALS

Table 7.1 reflects overall raw material proportions. Faraoskop is located fairly near to Elands Bay (Figure 2.1) and shows a similar raw material breakdown to the Elands Bay sites. Its two earliest assemblages show typically high quartz frequencies, but at 10 810 BP quartz is substantially higher in proportion than similarly dated EBCassemblages. Two reasons for this discrepancy can be suggested. Firstly, with lower sea-levels the less mature terminal Pleistocene Verlorenvlei, which flows over Table Mountain sandstone, would have provided a better source of pebbles than the Jakkalsrivier, which lies some 4 km south of Faraoskop, and flows through the Sandveld. Second, the conglomerates of the Pickenierskloof

Formation, which comprise the Elands Bay cliffs, would also have yielded pebbles in far greater numbers than may have been available around the small koppie on which Faraoskop is situated. This might indicate a reluctance to travel in search of raw materials despite the fact that non-quartz materials may have been better suited to the larger tools that were made at that time. With an active strategy of raw material conservation, however, there may not have been the need to range widely, with local sources of quartz being adequate to meet most needs.

Table 7.1 Later Stone Age raw material proportions.

Site	Date (BP)	% Quartz of total	% Quartzite of total	% Silcrete of total	% CCS of total	% all others of total
Faraoskop*	16 500	87.43	2.81	4.46	0.13	5.17
EBC	13 600	86.27	7.91	2.35	1.26	2.21
EBC	13 100	81.03	3.31	5.77	2.84	7.05
EBC	13 020	79.29	5.16	3.13	2.52	9.90
Faraoskop*	11 550	88.11	1.76	2.59	0.56	6.98
EBC	11 370	74.87	7.49	2.73	1.13	13.78
EBC	11 050	70.14	9.90	1.88	0.51	17.58
Faraoskop*	10 810	85.55	0.49	2.96	0.16	10.84
EBC	10 550	60.40	15.54	2.19	1.07	20.80
EBC	10 000	54.50	19.58	4.23	1.06	20.63
EBC	9650	55.82	25.97	2.02	1.01	18.18
EBC	9500	68.77	10.18	3.51	0.70	16.84
EBC	9300	71.89	11.83	3.55	0.89	11.83
EBC	8900	62.60	12.20	4.00	0.40	20.80
EBC	8800	86.93	5.07	1.23	0.08	6.70
EBC	8500	89.07	3.71	1.71	0.38	5.13
EBC	8000	77.30	7.57	7.03	0.54	7.57
DFM 1	Undated	89.77	1.89	5.68	0.79	1.89
JKBN**	4320	67.79	10.65	0	20.77	0.80
KN6-3C**	Undated	67.97	0.25	0	31.25	0.53
EBC	4300	81.32	6.03	4.96	1.07	6.62
EBC	4160	84.88	4.12	6.87	1.38	2.75
EBC	3900	79.09	6.29	5.41	0.88	8.33
PKM	3570	91.76	5.27	1.48	0.66	0.82
Steenbokfontein †	3550	85.2	11.4	1.2	0.9	1.3
SC	3510	89.19	4.05	2.48	2.93	1.35
EBC	3400	80.29	6.16	6.37	1.03	6.16
PKM	3000	83.31	7.93	3.62	1.67	3.48
SC	2970	72.88	13.56	0	0	13.56

Site	Date (BP)	% Quartz of total	% Quartzite of total	% Silcrete of total	% CCS of total	% all others of total
EBO	2920	91.09	3.26	3.91	0.43	1.30
PKM	2640	92.37	2.54	3.81	0	1.27
Steenbokfontein †	2600	70.2	19.7	5.8	2.0	2.3
Steenbokfontein †	2360	55.1	34.4	7.1	1.4	1.9
Steenbokfontein †	2200	68.0	22.4	5.0	2.8	1.8
EBC	2190	85.75	3.56	5.48	2.47	2.74
LKLK5**	1980	96.63	0.57	0.36	1.94	0.50
Biesje Poort 2**	1900	67.47	3.10	0	24.50	4.91
DFM 11	1780	95.13	0.67	1.18	0	3.03
EBC	1550	84.30	3.99	7.13	2.54	2.05
EBO	1470	83.60	7.94	1.06	0	7.41
EBC	1310	81.47	5.73	8.40	1.07	3.33
EBC	1000	79.59	6.07	8.41	2.07	3.86
HSM	950	88.15	11.11	0.74	0	0
PKM	880	98.33	0.83	0	0.83	0
SC	840	90.03	6.75	0.64	0	2.57
EBO	705	77.65	16.47	1.18	1.18	3.53
EBC	700	85.50	5.25	4.83	0.84	3.57
Faraoskop*	670	84.96	1.47	7.79	1.18	4.60
DFM 1	650	97.86	1.66	0	0	0.47
BPM	640	83.41	12.44	1.38	0.92	1.84
EBO	590	86.89	9.84	0.55	0.55	2.19
LKLK4**	580	99.06	0.16	0	0.16	0.63
PKM	570	93.79	4.35	1.86	0	0
EBC	550	79.55	9.09	7.20	1.14	3.03
Swartkop 1 ††	520	0.16	0.12	0	99.2	0.55
SC	460	74.74	11.58	1.05	0	12.63
Melkboom 1**	380	86.71	0.19	0	10.9	2.25
EBC	320	75.58	8.76	5.53	0	10.14

Sources: *Manhire (1993), data adjusted for the inclusion of manuports, hammerstones and ochre in the source data; **own data; †Jerardino & Yates (1996); ††own data and Orton (in press).

Two mid-Holocene assemblages have been included. Although as yet undated, KN6-3C (Figure 1.1) is considered by its excavators to date to the mid-Holocene by virtue of its stone tool assemblage composition (Halkett 2003). Both sites, and especially JKBN (Figure 1.1; Orton & Halkett 2001), are in areas where quartz and CCS are more readily available than near Elands Bay. A notable feature of both assemblages is that, despite the far greater access to quartz, much CCS was sought out and flaked. This indicates an obvious preference for fine-grained materials, which could not be exercised at Elands Bay due to the extremely

limited quantities in which they were available there. Silcrete, however, was slightly more readily available than CCS, and it is during the mid-Holocene period that we see the only relatively sustained period of increased silcrete use at Elands Bay (Figure 5.6). The very low frequencies of 'other' at both Northern Cape sites probably reflects the fact that quartz and CCS were readily available with little use of other materials being necessary.

Steenbokfontein Cave (Figure 2.1) presents a unique scenario with its 3550 BP assemblage having a relatively similar raw material breakdown to the Elands Bay sites, but its third millennium BP assemblages showing a dramatic reversal in the relative proportions of quartz and quartzite. With the possible exception of Spring Cave, which is a small assemblage, this change clearly did not occur at Elands Bay and is therefore unlikely to have been a temporal phenomenon. The 4000 – 6000 BP material from Steenbokfontein has not been included here due to the lack of dating resolution (Jerardino & Swanepoel 1999, Table 1), but despite its relatively low quartz frequency, its raw material pattern is considered fairly similar to that from the 3550 BP assemblage (Jerardino & Yates 1996). The quartzite used at this site is similar to that in which the cave is formed, suggesting an immediately local source (Jerardino & Yates 1996). This use of quartzite may have been prompted by reduced access to quartz compared with Elands Bay, while during the mid-Holocene greater effort was expended in obtaining quartz (3550 BP) and silcrete and CCS (4000 - 6000 BP). Yates (pers. comm.) suggests that the higher frequency of quartzite at Steenbokfontein may relate to the application of greater diligence in the identification of artefacts made from the local bedrock at this site than had been the case in earlier excavations such as at EBC.

Biesje Poort 2 and Melkboom 1, being located in the interior of the Northern Cape (Figure 1.1), both reflect the greater frequency of CCS and the lack of silcrete available in the local

landscape. LK5 and LK4, on the other hand, are located along the Namaqualand coast (Figure 1.1), not far from KN6-3C. Unlike the similarly dated Biesje Poort 2 and Melkboom 1 assemblages, both display an apparent reluctance to search for materials other than quartz. Interestingly though, both the LK5 and LK4 assemblages are comparable to DFM 1 and both seem likely to have been manufactured expediently (own data). Swartkop 1, also in the central Northern Cape (Figure 1.1) and manufactured almost exclusively on local CCS, is similarly expedient (Orton, in press). The data suggest that when expedience - defined by Bettinger (1991:69) as referring to tools manufactured “in direct response to an immediate need and (which) having served that need are discarded” - was required, little effort was put into raw material sourcing. Instead, the most obvious material was used.

In Chapter 6 it was suggested that the simultaneous low incidence of sheep and silcrete might suggest that hunter-gatherers had less access to this material than herders. Considering the available evidence from other nearby sites, summarised in Table 7.2, this is unlikely to have been the case. The 670 BP assemblage from Faraoskop has a noticeably inflated silcrete component and no sheep bones recorded in the deposits (Manhire 1993, pers. comm.). Tortoise Cave shows the same decrease in silcrete evident in the other Elands Bay sites (Robey 1987, Table 3). Although there is some inversion with respect to the dates and layers (Jerardino 1996, Table 4.1), it can be said that this drop in silcrete use coincides broadly with the appearance of sheep at the site. Despite the low incidence of sheep at DFM 1 (86 bones from 4 individuals), the presence of considerable dog gnawing (very seldom seen before 2000 BP) is thought by Klein (pers. comm.) to suggest that the people there may have been herders, but with their sheep kept elsewhere. DFM 1 contains no silcrete. These data suggest that, besides availability, the comparative silcrete frequencies at all sites in the area must be controlled by another factor, which, for the time being, remains unexplained.

Table 7.2 Post-2000 BP relative incidence of silcrete and sheep at western Cape sites.

Sites	Relative silcrete frequency	Relative sheep bone frequency
Elands Bay sites (current research)	Low	Low
Faraoskop (Manhire 1993)	High	Absent
Tortoise Cave (Robey 1987)	Low	High

Table 7.1 does not assist the explanation of the late reduction in quartz use in Elands Bay. No decrease is shown in Layer 1a from Tortoise Cave (Robey 1987, Table 3), which, although dated to 760 ± 50 BP (Pta-3600), contains European artefacts (Robey 1984; Miller & Markell 1993; Miller *et al.* 1998) suggesting a much later component to the assemblage. Similarly, Scorpion Shelter shows no reduction in quartz in levels dated after 450 BP (Wahl 1994, Appendix B) and Connie's Limpet Bar, dated to 390 ± 40 BP (Pta-4020), has 88.9% quartz, but in only a very tiny assemblage (own data). From these data, it seems unlikely that a real pattern of reduced quartz exists at all, and it is suggested that during the most recent times, lithic variability was generally at its greatest.

Tables 7.3 and 7.4 reflect the raw material frequencies in the formal tool and edge-damaged categories respectively. While these categories generally contain few artefacts, a number of assemblages do display the pattern illustrated in Chapter 1 of this dissertation.

Table 7.3 Later Stone Age formal tool raw material proportions.

Site	Date (BP)	% Quartz	% Quartzite	% Silcrete	% CCS	% all others	n
Faraoskop*	16 500	40.00	0	40.00	0	20.00	5
EBC	13 600	88.89	0	0	5.56	5.56	18
EBC	13 100	71.43	7.14	10.71	0	10.71	28
EBC	13 020	50.00	4.55	36.36	0	9.09	22
Faraoskop*	11 550	38.89	0	55.56	5.56	0	18
EBC	11 370	40.00	6.67	0	6.67	46.67	15
EBC	11 050	n/a	n/a	n/a	n/a	n/a	0

Site	Date (BP)	% Quartz	% Quartzite	% Silcrete	% CCS	% all others	n
Faraoskop*	10 810	0	0	100.00	0	0	1
EBC	10 550	81.25	0	6.25	0	12.50	16
EBC	10 000	50.00	50.00	0	0	0	2
EBC	9650	66.67	16.7	0	0	16.67	12
EBC	9500	83.33	0	16.67	0	0	6
EBC	9300	90.00	0	0	0	10.00	10
EBC	8900	70.00	0	10.00	0	20.00	10
EBC	8800	82.61	2.17	6.52	2.17	6.52	46
EBC	8500	80.95	0	0	4.76	14.29	21
EBC	8000	50.00	12.50	37.50	0	0	8
DFM 1	Undated	16.67	0	72.22	11.11	0	18
JKBN**	4320	28.38	0	0	71.62	0	222
KN6-3C**	Undated	10.95	0	0	89.05	0	137
EBC	4300	74.65	4.23	11.27	5.63	4.23	71
EBC	4160	75.00	0	0	0	25.00	4
EBC	3900	71.43	4.76	9.52	9.52	4.76	21
PKM	3570	72.73	0	18.18	9.09	0	11
Steenbokfontein †	3550	-	-	-	-	-	16
SC	3510	40.00	0	0	60.00	0	5
EBC	3400	83.33	8.33	0	0	8.33	12
PKM	3000	79.41	0	14.71	5.88	0	34
SC	2970	0	100.00	0	0	0	1
EBO	2920	57.14	0	42.86	0	0	14
PKM	2640	73.33	0	26.67	0	0	15
Steenbokfontein †	2600	-	-	-	-	-	67
Steenbokfontein †	2360	-	-	-	-	-	20
Steenbokfontein †	2200	-	-	-	-	-	17
EBC	2190	71.43	0	0	14.29	14.29	7
LKLK5**	1980	88.24	0	0	11.76	0	34
Biesje Poort 2**	1900	20.00	0	0	80.00	0	30
DFM 11	1780	n/a	n/a	n/a	n/a	n/a	0
EBC	1550	76.19	4.76	4.76	9.52	4.76	21
EBO	1470	100.00	0	0	0	0	3
EBC	1310	45.00	5.00	30.00	10.00	10.00	20
EBC	1000	47.06	5.88	23.53	11.77	11.76	17
HSM	950	n/a	n/a	n/a	n/a	n/a	0
PKM	880	0	0	0	100.00	0	1
SC	840	100.00	0	0	0	0	2
EBO	705	0	100	0	0	0	1
EBC	700	66.67	16.67	16.67	0	0	6
Faraoskop*	670	35.00	0	60.00	5.00	0	20
DFM 1	650	99.67	0	0	0	0.33	307
BPM	640	0	0	100.00	0	0	1
EBO	590	100.00	0	0	0	0	2
LKLK4**	580	100.00	0	0	0	0	19
PKM	570	66.67	0	33.33	0	0	3
EBC	550	50.00	25.00	25.00	0	0	4

Site	Date (BP)	% Quartz	% Quartzite	% Silcrete	% CCS	% all others	n
Swartkop 1^{††}	520	0	0	0	100.00	0	72
SC	460	100.00	0	0	0	0	1
Melkboom 1^{**}	380	42.86	0	0	55.10	2.04	49
EBC	320	66.67	0	33.33	0	0	3

Sources: *Manhire (1993); **own data; †Jerardino & Yates (1996); ††own data, Orton (in press).
 - = data not available; n/a = not applicable.

Table 7.4 Later Stone Age edge-damaged raw material proportions.

Site	Date (BP)	% Quartz	% Quartzite	% Silcrete	% CCS	% all others	n
Faraoskop*	16 500	55.56	0	11.11	0	33.33	9
EBC	13 600	73.08	0	19.23	2.56	5.13	78
EBC	13 100	78.02	0	12.93	3.88	5.17	232
EBC	13 020	87.23	0	2.13	4.26	6.38	47
Faraoskop*	11 550	80	0	20	0	0	15
EBC	11 370	62.50	4.69	12.50	1.56	18.75	64
EBC	11 050	27.78	11.11	22.22	0	38.89	18
Faraoskop*	10 810	n/a	n/a	n/a	n/a	n/a	0
EBC	10 550	63.04	8.70	4.35	8.70	15.22	46
EBC	10 000	72.73	0	9.09	9.09	9.09	11
EBC	9650	71.70	1.89	5.66	3.77	19.98	53
EBC	9500	93.33	6.67	0	0	0	15
EBC	9300	85.71	0	0	0	14.29	14
EBC	8900	81.25	0	12.50	6.25	0	16
EBC	8800	75.61	7.32	0	0	17.07	41
EBC	8500	82.76	0	3.45	0	13.79	29
EBC	8000	33.33	0	33.33	16.67	16.67	6
DFM 1	Undated	28.57	7.14	53.57	7.14	3.57	28
JKBN**	4320	43.07	0	0	56.20	0.73	137
KN6-3C**	Undated	43.86	0	0	56.14	0	57
EBC	4300	70.97	1.61	11.29	1.61	14.52	62
EBC	4160	83.33	0	0	0	16.67	6
EBC	3900	75.00	0	11.11	0	13.89	36
PKM	3570	95.56	2.22	0	2.22	0	45
Steenbokfontein[†]	3550	-	-	-	-	-	22
SC	3510	25.00	25.00	50.00	0	0	4
EBC	3400	50.00	0	25.00	12.50	12.50	8
PKM	3000	79.17	4.17	0	4.17	12.50	24
SC	2970	100.00	0	0	0	0	1
EBO	2920	53.85	7.69	15.38	7.69	15.38	13
PKM	2640	100.00	0	0	0	0	3
Steenbokfontein[†]	2600	-	-	-	-	-	93
Steenbokfontein[†]	2360	-	-	-	-	-	31
Steenbokfontein[†]	2200	-	-	-	-	-	21
EBC	2190	92.31	7.69	0	0	0	13

Site	Date (BP)	% Quartz	% Quartzite	% Silcrete	% CCS	% all others	n
LKLN5**	1980	90.91	0	0	9.09	0	11
Biesje Poort 2**	1900	31.25	0	0	68.75	0	16
DFM 11	1780	100.00	0	0	0	0	4
EBC	1550	60.53	7.90	26.32	5.26	0	38
EBO	1470	50.00	0	25.00	0	25.00	4
EBC	1310	75.86	0	17.24	3.45	3.45	29
EBC	1000	81.25	0	12.50	3.13	3.13	32
HSM	950	100.00	0	0	0	0	2
PKM	880	100.00	0	0	0	0	3
SC	840	83.33	0	16.67	0	0	6
EBO	705	33.33	33.33	0	33.33	0	3
EBC	700	50.00	0	41.67	8.33	0	12
Faraoskop*	670	27.78	0	44.44	11.11	16.67	18
DFM 1	650	100.00	0	0	0	0	74
BPM	640	20.00	20.00	40.00	20.00	0	5
EBO	590	50.00	50.00	0	0	0	2
LKLN4**	580	100.00	0	0	0	0	24
PKM	570	100.00	0	0	0	0	1
EBC	550	100.00	0	0	0	0	2
Swartkop 1^{††}	520	0	0	100.00	0	0	100
SC	460	100.00	0	0	0	0	1
Melboom 1**	380	77.02	0	0	21.62	1.35	74
EBC	320	100.00	0	0	0	0	4

Sources: *Manhire (1993); **own data; †Jerardino & Yates (1996); ††own data, Orton (in press)

- = data not available; n/a = not applicable

NB: the Faraoskop data have been adjusted to account for the inclusion of hammerstones, manuports and ochre in the source data. Ochre had been included in the 'other' category while hammerstones and manuports are here assumed to have been quartzite.

The earliest Faraoskop assemblage unfortunately contains few formal tools, although that from 11 550 BP and the four oldest EBC assemblages contain sufficient quantities to allow a pattern to emerge. In keeping with the high overall frequencies of quartz in the older assemblages (Table 7.1), many tools are made in this material, although its use declines steadily until about 10 550 BP when high quartz frequencies are once more evident among the tools. Since overall quartz frequencies reach their lowest during the latter part of this period, and fine-grained materials are more suited to retouching, the decision to retouch quartz so frequently probably relates to its good edge qualities and ubiquitous local

availability. Amongst the formal tool and edge-damaged categories it is clear that, when available, silcrete is usually used more frequently than in total.

During the mid-Holocene, and indeed also at 8000 BP when 'Wilton-type' assemblages first appear in EBC, quartz use declines considerably among both edge-damaged and formal tools, with materials such as silcrete and CCS receiving far more attention. This increased use of fine-grained materials in the company of still high overall quartz frequencies is coincident with the increase in well-crafted, standardised tool forms which required fine materials for their manufacture. Thus, a conscious choice to use these materials is present at this time. Sites in areas with better access to fine-grained materials reflect this trend much more strongly, with JKBN and KN6-3C both showing very high frequencies of CCS among the formal tools and edge-damaged pieces. This pattern continues to manifest itself, albeit weakly in places, throughout the remainder of the Holocene both at Elands Bay and elsewhere, although low tool counts prevent it being traced through the most recent assemblages.

7.2 TECHNOLOGY

Table 7.5 provides details of a selection of technological factors. I shall address the formal : edge-damaged ratio first, followed by the bipolar cores, the blades and finally the ratio of flakes and blades to chunks.

Table 7.5 Later Stone Age technology.

Site	Date (BP)	Formal : edge-damaged	% Bipolar cores of total cores	% Bipolar cores of quartz cores	% Blades of total	% Blades of quartz flakes & blades	% Blades of silcrete & CCS flakes & blades	Flakes & blades : Chunks
Faraoskop*	16 500	0.56	51.85	-	7.21	-	-	0.79
EBC	13 600	0.23	81.40	81.97	6.43	10.15	14.49	2.22
EBC	13 100	0.12	52.22	55.68	3.76	5.96	16.91	1.84
EBC	13 020	0.47	60.00	68.87	3.90	6.75	23.08	2.45
Faraoskop*	11 550	1.20	42.11	-	7.23	-	-	0.72
EBC	11 370	0.23	67.44	75.00	1.36	2.90	9.68	1.54
EBC	11 050	0	83.58	91.67	2.10	5.13	0	2.28
Faraoskop*	10 810	n/a	n/a	-	1.41	-	-	0.68
EBC	10 550	0.35	57.72	62.96	1.99	5.90	8.33	1.45
EBC	10 000	0.18	37.50	60.00	0.63	2.44	0	1.77
EBC	9650	0.23	64.20	65.71	0.88	2.73	4.76	1.38
EBC	9500	0.40	27.78	31.25	1.20	1.09	0	2.41
EBC	9300	0.71	58.07	57.69	0.61	0.81	10.00	2.09
EBC	8900	0.63	51.85	56.00	1.76	4.26	7.14	1.99
EBC	8800	1.12	56.90	55.56	0.89	1.26	16.67	1.37
EBC	8500	0.72	49.43	53.16	0.79	1.59	0	1.81
EBC	8000	1.33	55.56	62.50	1.49	0	33.33	0.89
DFM 1	Undated	0.64	27.78	31.25	1.11	2.74	6.73	0.69
JKBN**	4320	1.62	24.60	35.00	1.40	1.91	3.82	2.14
KN6-3C**	Undated	2.40	36.00	27.03	2.96	5.76	5.83	2.03
EBC	4300	1.15	58.70	62.81	2.86	5.01	18.42	1.36
EBC	4160	0.67	65.22	71.43	2.52	2.73	21.43	1.88
EBC	3900	0.58	46.81	46.34	1.52	2.63	10.00	1.20
PKM	3570	0.24	18.18	21.05	0.49	0	0	0.81
Steenbokfontein †	3550	0.73	83.33	-	1.87	-	-	1.39
SC	3510	1.25	75.00	83.33	0.36	0.84	0	1.23
EBC	3400	1.50	39.29	43.48	2.64	2.97	13.04	2.34
PKM	3000	1.42	45.00	50.00	1.43	1.94	20.00	1.56
SC	2970	1.00	100.00	100.00	0	0	n/a	0.53
EBO	2920	1.08	33.33	40.00	0.54	0.70	14.29	0.94
PKM	2640	5.00	57.14	57.14	0	0	0	1.39
Steenbokfontein †	2600	0.72	74.07	-	1.62	-	-	1.54
Steenbokfontein †	2360	0.65	75.00	-	0.61	-	-	1.20
Steenbokfontein †	2200	0.81	64.71	-	0.98	-	-	1.19
EBC	2190	0.54	59.26	69.57	1.97	4.11	7.14	1.33
LKLK5**	1980	3.09	49.06	47.92	3.27	5.86	0	1.93
Biesje Poort 2**	1900	1.88	27.27	37.5	11.31	1.72	15.87	5.84
DFM 11	1780	0	87.50	87.50	1.10	2.26	0	1.32
EBC	1550	0.55	43.94	50.00	0.76	0.86	7.69	1.79
EBO	1470	0.75	50.00	100.00	0	0	0	0.77

Site	Date (BP)	Formal : edge-damaged	% Bipolar cores of total cores	% Bipolar cores of quartz cores	% Blades of total	% Blades of quartz flakes & blades	% Blades of silcrete & CCS flakes & blades	Flakes & blades : Chunks
EBC	1310	0.69	42.11	42.19	0.95	1.29	9.09	1.67
EBC	1000	0.53	51.43	54.10	2.01	2.57	13.64	2.39
HSM	950	0	85.71	85.71	2.68	7.3	0	1.34
PKM	880	0.33	66.67	66.67	0	0	n/a	0.96
SC	840	0.33	87.5	87.5	0	0	n/a	1.10
EBO	705	0.33	n/a	n/a	0	0	0	0.36
EBC	700	0.50	70	70	2.12	5	0	1.34
Faraoskop*	670	1.11	50.00	-	2.13	-	-	0.65
DFM 1	650	4.15	95.73	96.91	2.25	6.66	n/a	0.86
BPM	640	0.20	77.78	87.5	0	0	n/a	0.64
EBO	590	1.00	63.64	100	1.24	5.13	n/a	0.47
LKLK4**	580	0.79	46.67	50	1.57	2.52	n/a	2.84
PKM	570	3.00	100	100	1.19	2.56	n/a	1.39
EBC	550	2.00	38.89	50.00	4.15	8.00	28.57	1.16
Swartkop 1 ††	520	0.72	0	n/a	17.67	0	20.9	12.78
SC	460	1.00	66.67	50.00	0	0	0	1.40
Melkboom 1**	380	0.66	15.91	14.63	7.23	4.19	9.17	3.30
EBC	320	0.75	45.46	45.45	1.15	3.64	0	1.03

Sources: *Manhire (1993); **own data; †Jerardino & Yates (1996); ††own data, Orton (in press).

The ratio of formal tools to edge-damaged pieces will give a reasonable indication of the importance attached to retouch with regard to those pieces used in some way after the initial flaking. With many utilised artefacts escaping unnoticed during analyses, this ratio should always be lower than those presented below. A relative measure is, however, still possible from the current figures.

The early Faraoskop values are far higher than those from EBC, probably reflecting conservative identification of the damaged edges at the former site, since only a hand-lens was used to aid analysis (Manhire, pers. comm.). The current research was conducted using a binocular light microscope which allowed many more minute flake scars to be seen and correctly classified. It is generally more difficult to identify the features on quartz artefacts

than on other materials. In assemblages with such high quartz frequencies, this can lead to artefacts being classified in higher or lower classes respectively, depending on whether surface irregularities on the artefacts are identified as modification or vice versa (Mehlman 1989). As such, we can expect the real Faraoskop ratio to be slightly lower, thus bringing them more into line with EBC. We know that during the late Pleistocene formal tools were relatively uncommon (Mitchell 2002b) and the data in Table 7.5 certainly reflect this.

During the mid-Holocene, JKBN and KN6-3C reflect far higher frequencies of formal tools than are evident at Elands Bay. One often finds fairly low formal tool frequencies in coastal shell middens (Maggs & Speed 1967; Van Noten 1974; Avery 1976), possibly accounting for the relatively low ratios at Elands Bay during the Holocene, although exceptions do occur (e.g. DFM 1, Orton 2002; KN6-3C, Halkett 2003). Klein (1974) has suggested that bone and shell tools may have complemented stone tools at the coast, contributing to their low incidence. Although bone tools, predominantly points, are routinely found in small (e.g. J. Deacon 1984a, b; Mitchell 1995) and occasionally large numbers (e.g. Parkington 1992, Table 4), shell tools are less common with *Donax* scrapers being found in small numbers from time to time and the utilised limpets from PKM (Jerardino 1998) being quite unique. KN6-3C (Halkett 2003), like DFM 1, is interesting in that it too is a shell midden containing an unusually high –although not overwhelming – frequency of one type of tool, in this case the borer (own data). This undoubtedly contributes to the extra high ratio of formal tools to edge-damaged pieces evident at both sites. Swartkop 1 is also dominated by a single tool type (Orton, in press) and has a far lower ratio than similar age coastal sites, suggesting that the coastal-inland dichotomy is not always clear. The blades at Swartkop 1, however, are generally far larger than those from DFM 1 (Orton, in press) and may often have been used unretouched and probably unmounted. Those from DFM 1 are assumed, from the occasional

mastic traces still clinging to some tools, to have been mounted for use (Orton 1998). As such, it seems that the frequency of retouched tools relative to edge-damaged pieces is likely to be governed by various factors including available raw materials, required functions of the artefacts and whether the site is a coastal shell midden or not. The former is likely to be the most influential, with good quality being a necessity when high numbers of tools are to be made.

The Steenbokfontein data are comparable to those from Elands Bay, although it appears that between about 3500 and 2600 BP formal tools were relatively more important at Elands Bay. Regrettably, few comparably aged assemblages are available for comparison from the western Cape. Scorpion Shelter (Figure 2.2) shows this pattern to some extent (Table 7.6), although the dating is not finely enough resolved to be able to ensure exact equivalence. Tortoise Cave shows a high formal to edge-damaged ratio throughout, but having been analysed some twenty years ago (Robey 1984), it too is unlikely to have been subjected to as rigorous a microscopic examination as the Elands Bay samples in the current research.

Biesje Poort 2, an inland site with a good proportion of CCS, shows almost two formal tools to each edge-damaged piece. LKLK5, like DFM 1, has an unusually high ratio in an assemblage not dissimilar to DFM 1. It too is manufactured almost exclusively on fine crystal quartz and has a relatively high frequency of backed bladelets (own data).

It is interesting that between 590 and 460 BP we see the opposite trend to the usual one, with higher frequencies of formal tools occurring at Elands Bay and lower frequencies inland at Swartkop 1 and Melkboom 1. The most recent assemblages, however, especially in areas experiencing colonial contact, are less likely to provide reliable indicators of lithic

assemblage trends due to the far greater variability typically seen in them. This may also be a result of access to metal tools.

Table 7.6 The ratio of formal tools to edge-damaged pieces by excavated unit from Scorpion Shelter.

Excavation unit	Formal : edge-damaged*	Date (lab no.)**
Surface	0.33	
DSS 1	0.67	
DSS 2	1.33	
DSS 3	0.57	
DSS 4	2.5	
DSS 5	0.57	450±35 BP (Pta-6340)
DSS 6	1.14	
DSS 7	0.79	
DSS 8	0.71	1040±50 BP (Pta-6480)
DSS 9	0.29	
DSS 10	0.44	
DSS 11	0.20	2957±60 BP (Pta-7354)†
DSS 12A & 12	1.80	
DSS 13	0.83	
DSS 14	0.36	3387±20 BP (Pta-6341)†
DSS 15A & 15	1.00	
DSS 16	0.25	
DSS 17	0.25	
DSS 18	0.43	
DSS 19	0.28	

Sources: *Wahl (1994), Table 1; **QUADRU, n.d.

† Marine date corrected by the procedure set out in Section 4.2.

I turn now to the bipolar core data contained in the fourth and fifth columns of Table 7.5. It is clear that raw materials play an important role in determining both the reduction methods used by the stone workers and the types of artefacts that were produced. With the Elands Bay assemblages being dominated by relatively poor quality quartz, which generally occurs in small nodules, the stone was primarily reduced via the bipolar technique. As such, we see higher bipolar frequencies among the quartz than other raw materials.

Slightly fewer bipolar cores occur at Faraoskop than at EBC. Without knowing how many are present in each raw material at the former site, it is difficult to assess the reasons for this

phenomenon. The occupants of both JKBN and KN6-3C have had access to better quality and larger quartz nodules, with the result that bipolar core frequencies are much reduced at those sites. Steenbokfontein Cave shows the frequencies we would expect, while the lower values from the remaining Northern Cape sites presumably all reflect improved raw material quality and size allowing non-bipolar flaking techniques to be used.

Columns six to eight in Table 7.5 provide data pertaining to the blades and bladelets present in each assemblage. The term “blade” is here used in the generic sense to refer to both size classes. It is clear that, other than at two of the Northern Cape late Holocene sites, blades are never very frequent and are more commonly made on the better quality raw materials than on quartz, reflecting the brittle nature of the latter which causes it to fracture unpredictably.

As noted in Chapter 5, when compared with sites in the southern and eastern parts of southern Africa, bladelets are relatively scarce in the Elands Bay late Pleistocene microlithic assemblages. With so few bladelets there, minimal late Pleistocene occupation in the Northern Cape (Humphreys & Thackeray 1983), and only macrolithic assemblages from that time in Namibia (Wendt 1972, 1976), it appears as though bladelet production was centred in the south-eastern parts of southern Africa, tapering off to the west and north-west. This pattern changes during the Holocene, although the high frequencies of the late Pleistocene are never again achieved.

The relatively low Pleistocene bladelet frequencies at Faraoskop and EBC are comparable with many other quartz dominated southern African sites (Mitchell 1988a, 1988b). To the east, in areas where CCS is far more frequently used, overall blade frequencies are far higher (e.g. Mitchell 1988a, b; Binneman & Mitchell 1997). JKBN perhaps has slightly lower blade

frequencies than might be expected, while the almost equal values for quartz and CCS at KN6-3C betray the high quality quartz available in Namaqualand. Steenbokfontein has the low values expected of the western Cape area, while the Northern Cape sites demonstrate that blades will be more frequent when access to fine-grained materials is greater.

The final technological factor under consideration here is the ratio of flakes and blades to chunks. This ratio would have been influenced by both the skill of the stone knapper and the size and quality of the available raw materials, although it is not really possible to tell which factor is the most significant in each case. With the lower incidence of bipolar cores and higher incidence of blades at Faraoskop, poor quality raw materials are unlikely to be the cause of the consistently low flake and blade to chunk ratios at that site during the late Pleistocene. Instead, the differential interpretation of what constitutes a flake might be responsible with varying interpretations being easily possible, as discussed in Section 3.2.3 above. Manhire (pers. comm.) has suggested that his classification of artefacts as flakes is likely to have been more conservative than most, especially since it was performed without the aid of a microscope making the identification of flake features more difficult.

The Northern Cape sites generally have higher flake and blade to chunk ratios, almost certainly the result of the superior quality raw materials present in that province. Table 7.7 demonstrates the raw material factor by way of showing this ratio for some of the Northern Cape sites that have a fairly large proportion of both materials. The CCS ratios are generally significantly higher than those for quartz, although, interestingly, the pattern does not always hold true as indicated by the Melkboom 1 data. The high frequencies of single platform and irregular cores at that site suggest a higher quality of quartz, possibly explaining the higher

flake count in that material. Biesje Poort 2 must also have superior quality quartz, although its core count is too low to judge by that means.

Table 7.7 Flake and blade to chunk ratios for quartz and CCS at Northern Cape sites.

Assemblage	Quartz	CCS
JKBN	1.85	2.85
KN6-3C	1.81	2.74
Biesje Poort 2	4.95	18.9
Melkboom 1	3.43	2.53

Source: own data

The Steenbokfontein data are again comparable to those from Elands Bay, indicating access to a similar suite of materials. Swartkop 1, however, has an extremely high flake and blade count (Orton, in press), due certainly to the combined effects of the size and quality of the nodules of raw material available to the stone knappers. This assemblage actually has greater numbers of blades than bladelets, itself a rare phenomenon, indicating that original raw material nodule size must have been considerably larger than any other site in the current selection.

In summary, the relative availability of raw materials has a major effect on their selection and use by prehistoric people in all areas, implying that the extreme dominance of quartz in the Elands Bay assemblages can certainly be ascribed primarily to its widespread availability in the local landscape. The degree of manufacturing expedience, especially in the later sites, also had an effect, although only at a secondary level.

Although the earliest Faraoskop data are enigmatic. It seems that quartz was desired most strongly for formal tools and edge-damaged pieces during the late Pleistocene to early

Holocene. Thereafter, and coincident with the decrease in artefact sizes, fine-grained materials became more desirable for use, although were seldom obtained in any quantity.

The generally greater importance of formal tools in the mid-Holocene (Mitchell 2002b) is shown to be true in Elands Bay. Interestingly, formal tools were also more strongly emphasised in the millennium between about 3500 and 2600 BP in the western Cape. When raw material quality increases, formal tools become more important relative to edge-damaged pieces, while the ratio is also improved in sites where a single tool type dominates strongly, perhaps due to the performing of specific tasks.

Bipolar reduction is strongly related to raw material quality and size, with better materials allowing the use of other flaking techniques. Blades are never common in the western parts of South Africa with their frequency also largely controlled by the quality of available raw materials. Most notable is the low Pleistocene blade frequency in the west compared to the eastern parts of the subcontinent where CCS is far more common. As expected, sites with better raw materials have more flakes and blades compared to chunks.

8 CONCLUSIONS

This concluding chapter explores a number of topics related to the Elands Bay lithic assemblages. Some have arisen directly from this research, while others have been raised by other researchers in the past and are compared to the present results.

8.1 THE QUARTZ CONUNDRUM: STRATEGIES OF RAW MATERIAL

CONSERVATION

Any study of quartz in Elands Bay has to include a detailed consideration of the bipolar technique, since the two are clearly inextricably linked. This study has shown that although fine-grained materials were desired, especially for formal tools and utilisation, quartz was used out of necessity in Elands Bay throughout the LSA. Of the commonly available materials quartz was certainly the most prized, since when worked by experienced craftsmen, it could yield retouched artefacts of high quality. Strategies of raw material use have changed over time, along with the relative proportions of quartz and other materials employed. Expediently planned bipolar assemblages made on quartz occur primarily during the late Holocene, while during the late Pleistocene to early Holocene, people had a more conservative attitude towards quartz use, with other flaking techniques being more frequently used.

The higher-than-expected frequency of bipolar cores during the two earliest periods of the LSA is almost certainly due to the reuse of other core types as bipolar cores in an attempt at maximum economy of raw material. At Rose Cottage Cave, A. Clark (1999) has suggested that the bipolar technique is unlikely to have produced many bladelets, with indirect or punch techniques having been used. My bipolar experiments (Appendix 1) support this contention,

and it seems probable that during the terminal Pleistocene, single platform bladelet cores were the most likely source of bladelets. Furthermore, people are unlikely to have invested much effort directly on a reduction strategy from which bladelets were primarily produced by chance. Despite these points, the artefacts appear to indicate an expedient bipolar industry. Perlès (1992) suggests that the dominant class of tools will determine the reduction strategy employed, with other artefacts simply being made from the by-products of that technique. With the late Pleistocene microlithic being focussed on blade production, I consider bipolar flaking to be a secondary mechanism, succeeding single platform working, and aimed at maximising the production of flakes of any sort. The manufacture of bladelets is itself a raw material conservation strategy: once a core has been shaped, bladelet production becomes more predictable with few subsequent flakes being unusable and longer working edges being produced (Nelson 1991 and references therein; Belfer-Cohen & Goring-Morris 2002).

Similarly, bipolar cores seem far too common in the nonmicrolithic assemblages, and the large scraper blanks produced then were certainly not struck from these cores. With just one exception, the conservative approach at this time would have encouraged the use of non-bipolar techniques as much as possible, with a reversion to bipolar flaking only to maximise flake production. The exception itself constitutes a further quartz-saving device, and is evident in the existence of what are sometimes termed split-pebble and pebble scrapers. In the former, pebbles would have been split, probably by one or two bipolar strikes as necessary, and the resulting halves retouched (Figure 8.1, a-c), while in the latter, the practice was taken to the extreme with scraper edges retouched directly onto relatively flat pebbles (Figure 8.1, d-e). By retouching such pieces, the chance of further reduction destroying large blanks is eliminated.

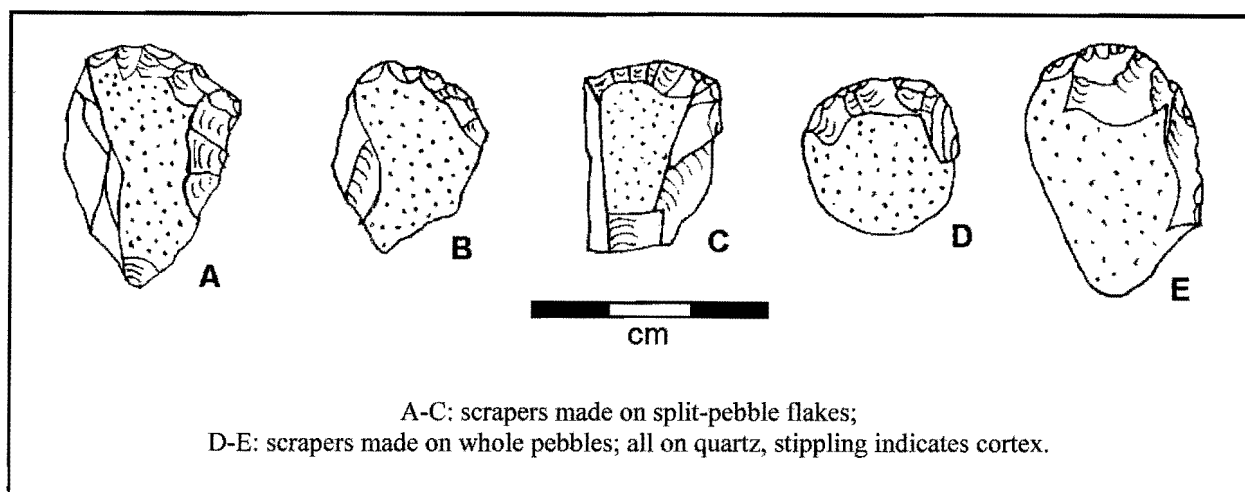


Figure 8.1 Split-pebble and pebble scrapers from unit PELE in EBC (8500 BP).

Later, as the Holocene microlithic period began, people reverted to microlithic technology as a 'new' conservation strategy (Ambrose 2002), with small flakes and tools being commonly produced. During the late Holocene, lithic assemblages were less formal, both in terms of reduction strategies and formal tools. The importance of raw material conservation diminished, with artefact production being aimed solely at the manufacture of flakes of any shape, but with usable edges. This may have been due to changes in social relations and group mobility with the introduction of pastoralism to the area some 2000 years ago. Of course exceptions will always occur, with DFM 1 being the obvious example.

In the opening chapter of this dissertation I asked the question: "Why is such a high frequency of quartz maintained in lithic assemblages when other raw materials appear to have been continually available, albeit in small quantities, and sometimes also preferentially used in tool manufacture?" With the lack of easy access to other materials near Elands Bay, it appears that people were content to use quartz, but at times applying conservative strategies of reduction in order to maximise the potential of each nodule. When other materials were available, probably through chance acquisition, they were taken full advantage of, with high frequencies of edge-damaged pieces and formal tools being the result. The very high

frequencies of quartz artefacts in many assemblages can therefore be seen as a result of the combination of high intensity exploitation and the fact that its physical properties are conducive to the production of many tiny fragments when subjected to bipolar flaking.

8.2 A MODEL OF 'SPORADIC CHANGE'.

This research has raised some interesting issues pertaining to raw material usage and flaking techniques in the LSA of the Elands Bay area. It has tended to support the view that lithic technology has been gradually evolving over time, with the rate of change being somewhat variable. Although the three commonly recognised industrial traditions are clearly present, none are particularly well developed or stable, and transitional assemblages have been identified between them. Interestingly though, there are no 'intermediate' features to these assemblages; rather we see certain features of the earlier assemblages continuing, while features of the next tradition begin. This would suggest a model in which industrial change, at least at Elands Bay Cave (the only site in the research area with deposits old enough to contain all three traditions), is represented more by a sequence of individual technological and raw material characteristics appearing and disappearing sporadically, than by a sequence of suites of characteristics doing the same. As such, there would be certain characteristics falling within only one of the industrial traditions, while others would overlap, perhaps falling within more than one tradition as well as into the transitional assemblages in between. This model of 'sporadic change' supports the views of Parkington and Yates (in prep. a), but not the model of "homeostatic plateaux" proposed by H. Deacon (1976) in the southern Cape. These models are presented schematically in Figure 8.2.

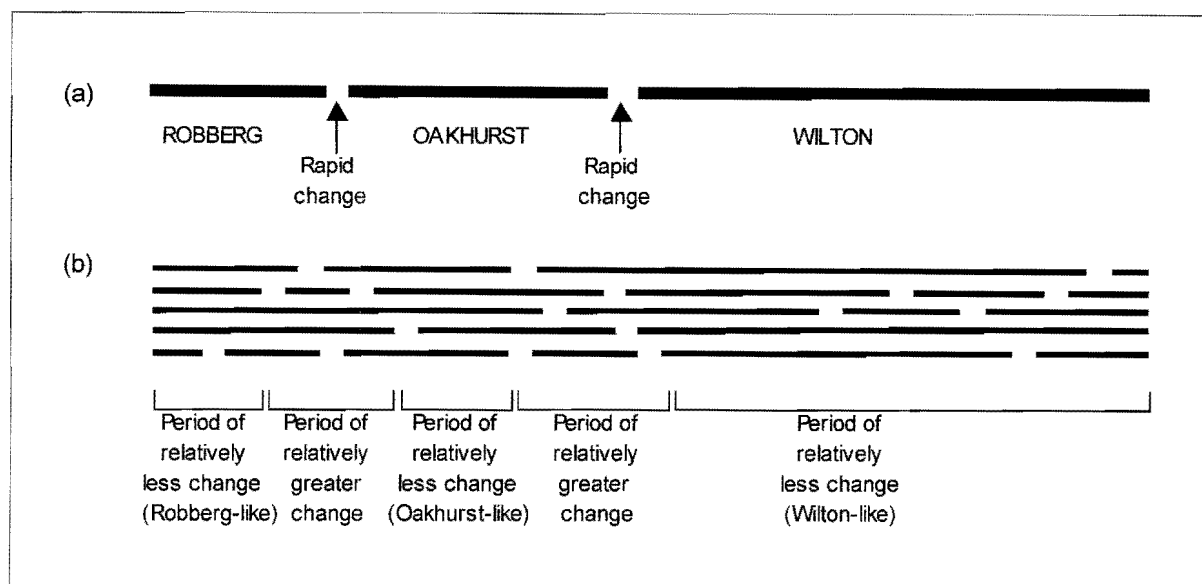


Figure 8.2 Schematic representation of the models of (a) homeostatic plateaux (H. Deacon 1976) and (b) sporadic change (this research).

H. Deacon's (1976) model assumes the co-incident occurrence of strong positive feedback from environmental, subsistence and technological variables that promoted change between the major artefact-making traditions. Negative feedback is expected to have caused minor adjustments to each industry, such that plateaux of relative stability are maintained. In Figure 8.2 (a) each line represents a 'plateaux', or suite of industrial elements. In Figure 8.2 (b), each line represents one technological element, with the gaps being times when that element experienced change. At times when transitional assemblages occur, there are simply more of these gaps. At other times far fewer changes occur, representing the 'Robberg-', 'Oakhurst-' and 'Wilton-like' periods.

The nature of the two major transitions at Elands Bay can also be explored. No abrupt changes occurred during the late and terminal Pleistocene occupations of EBC, with industrial change being a slow, gradual process taking place over a number of millennia.

Although clear 'Robberg-like' and 'Oakhurst-like' assemblages exist, it is not possible to confidently say exactly when they end and begin respectively. The divisions in Table 5.2 make this clear. Ambrose and Lorenz (1990) consider gradual raw material shifts to have pre-empted more rapid technological change around 12 000 years ago at Nelson Bay Cave, but with the far more gradual sequence of change evident at EBC (Table 5.2), this sort of judgement cannot be made there. On the other hand, when one considers the shift from 'Oakhurst-' to 'Wilton-like' technology, slightly more rapid change is evident. It is still not possible, however, to say where these periods end and begin respectively, since the transitional assemblages clearly contain elements of both.

Where the difference lies, is in the rapidity with which new technological elements were introduced. In the earlier transition, all change occurred gradually, while after 8900 BP and 8500 BP significant changes, but only to certain elements, are seen in the assemblages. This difference is evident in Tables 6.5 and 6.6, where it can be seen that in the latter, many more later elements are introduced in quick succession than in the former. It is unfortunate that there is a post-8000 BP hiatus at EBC, but at 8000 BP there is just enough to be able to say that a clear 'Wilton-like' industry had finally developed.

8.3 SOME GENERAL TRENDS WITH REGARDS TO QUARTZ IN THE ELANDS BAY

LSA

Focussing on quartz, I now present some scatter plots incorporating all the Elands Bay data. Correlation coefficients are not presented, since all are low, indicating firstly that trends were not consistently applicable throughout the LSA, and secondly that small samples have produced outliers that do not reflect the patterns contained in the bulk of the data. Related to this first point is the fact that distinct clusters of similar assemblages exist in each of the

graphs below, emphasising the presence of short-lived trends. By examining the relative positions of these clusters, one can track the general sequence of change through time. In general, the late quartz-rich assemblages tend to display more variety, reflecting the establishment of more informal lithic strategies and a reduced emphasis on raw material conservation. The different periods are marked separately on the graphs, and can be identified as follows:

■	13 600 –11 370 BP
□	11 070 –10 550 BP
◇	10 000 –8900 BP
◇	8800 –8500 BP
+	8000 –3400 BP
×	3000 –1000 BP
△	950 –570 BP
■	550 –320 BP

On the whole the correlation between quartz and bipolar cores is not as strong as might have been expected, with the differential attention to raw material conservation probably affecting this. It is clear from Figure 8.3, however, that quartz-poor assemblages never contain high frequencies of bipolar cores and quartz-rich ones seldom have low frequencies. Also evident, is the clear observation that most assemblages contain between 70% and 90% quartz and between 2% and 4% bipolar cores, suggesting that, given the constraints on raw material access in the area, these are the most likely frequencies to be encountered

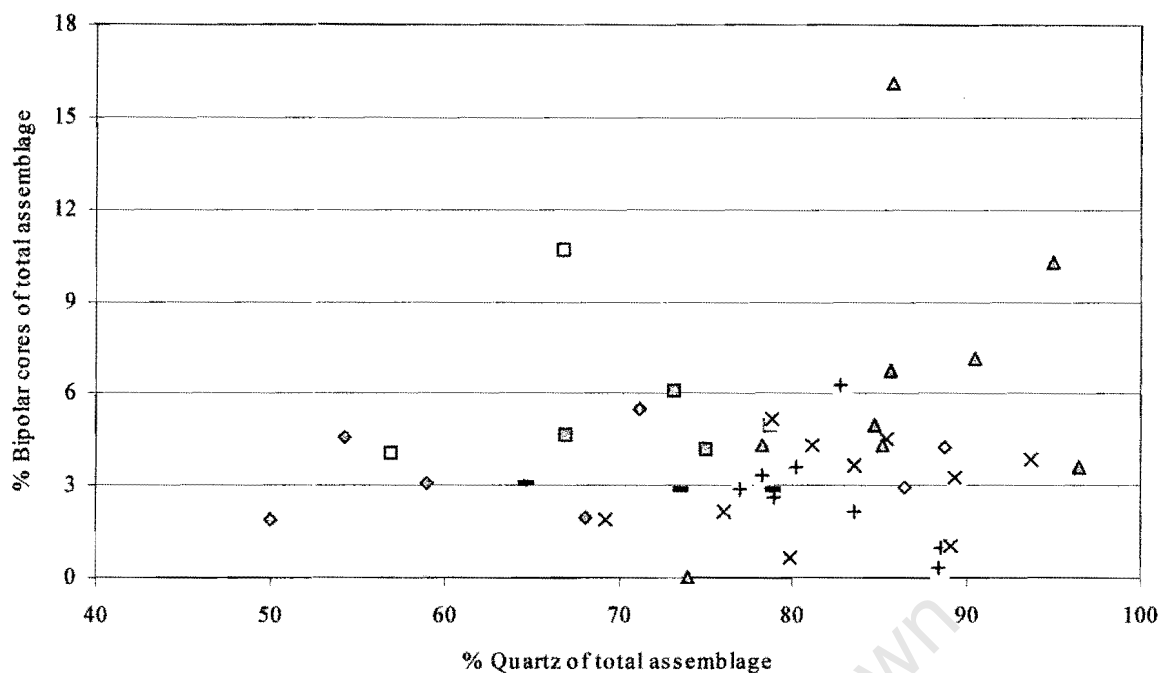


Figure 8.3 The relationship between quartz and bipolar cores in all analysed assemblages.

The strongest patterns emerging from this study comprise the relationships between quartz and edge-damaged pieces. Almost all assemblages fall into a clear relationship in which frequencies of edge-damaged pieces decline as those of total quartz increase (Figure 8.4), while at the same time greater frequencies of edge-damaged pieces are made of quartz (Figure 8.5). This pattern is consistent with the strategies of raw material conservation outlined above: at times when quartz was most commonly used, the high quality edges allowed fewer flakes to be used, while when quartz was less common, more flakes of other materials were used in order to conserve quartz, perhaps for tool manufacture. The cluster of nine assemblages with $y = 100\%$ at the top left corner of Figure 8.5, are explained by low artefact counts, with only the unique DFM 1 (650 BP) assemblage having more than 4 edge-damaged pieces.

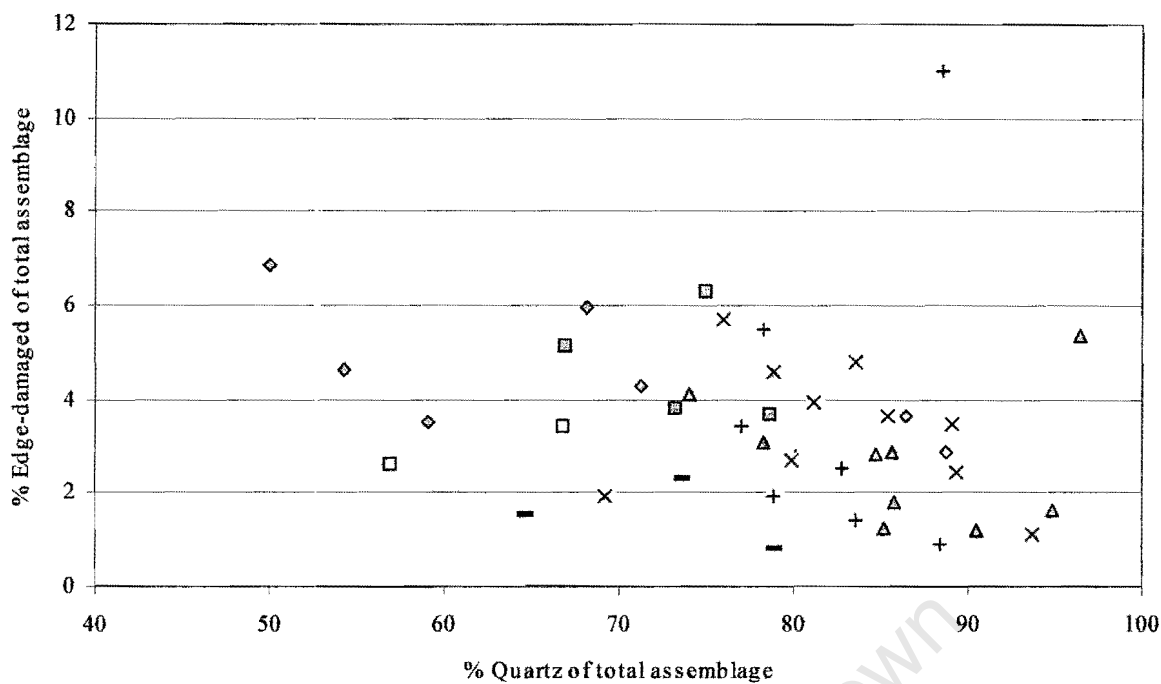


Figure 8.4 The relationship between quartz and edge-damaged pieces in all analysed assemblages.

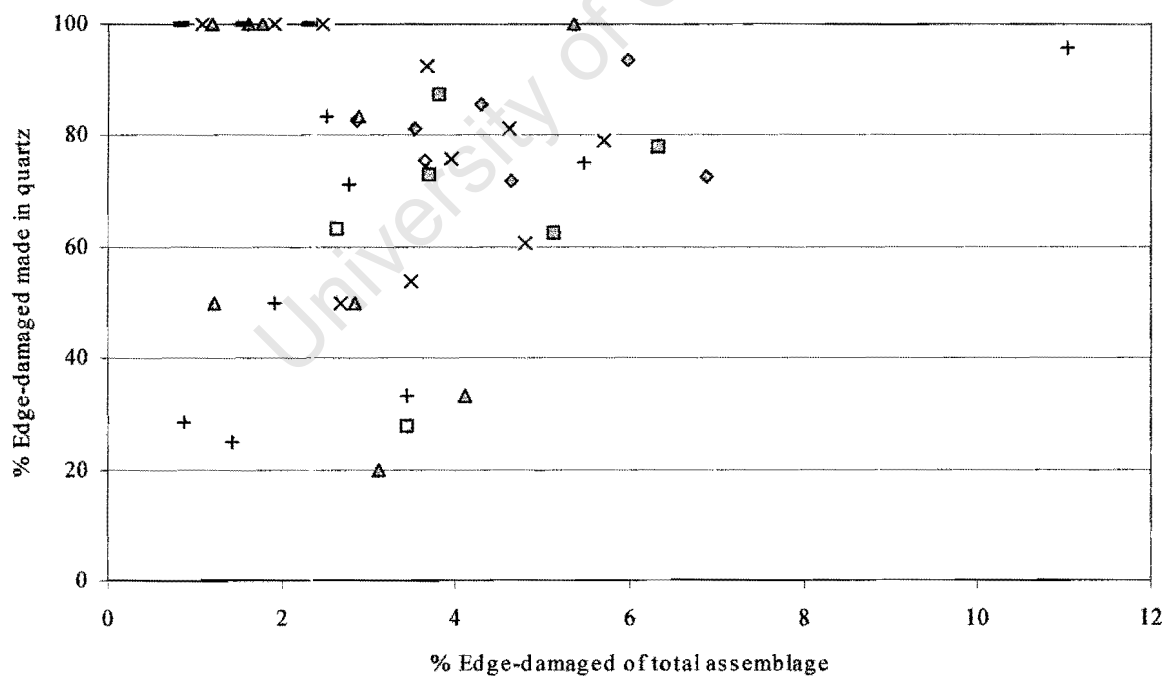


Figure 8.5 The relationship between edge-damaged pieces and edge-damaged pieces made in quartz in all analysed assemblages.

Figure 8.6 shows the frequency of quartz plotted against that of formal tools. Although fine-grained materials were targeted for retouch when available (Figures 5.41 & 5.42), the low overall frequency of these materials meant that, numerically, most tools were still made of quartz. Although again only a weak correlation exists, the graph does show that quartz-rich assemblages tend to contain slightly elevated frequencies of formal tools. From the relative position of the x's and +'s, it is apparent that, as in most southern African sites (Mitchell 2002b), the Elands Bay 'Wilton-like' period tends to show the highest formal tool frequencies. Late Pleistocene and late Holocene assemblages are united by their low incidence of formal tools accompanied by high quartz frequencies. With the numerous smaller sites recorded for the late Holocene, more variability exists at that time, and some assemblages show markedly higher proportions of both quartz and formal tools.

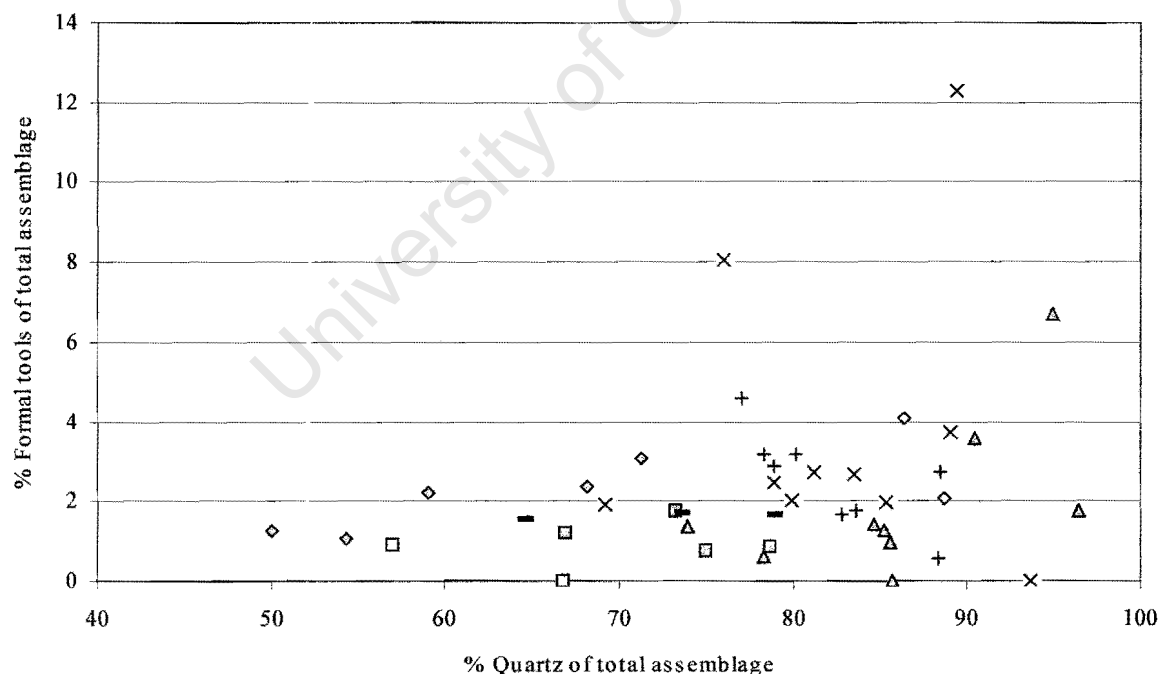


Figure 8.6 The relationship between quartz and formal tools in all analysed assemblages.

8.4 CURATION, EXPEDIENCY AND OPPORTUNISTIC STRATEGIES.

Curated and expedient planning strategies frequently inter-link, being used sequentially as necessary (Nelson 1991), and most Elands Bay assemblages demonstrate a combination of the two. Curation anticipates future needs, with planning taking place accordingly: curated items (tools, cores or raw material) are saved, in one way or another, for later use (Bettinger 1991; Nelson 1991). Expedient planning anticipates the on-site availability of manufacturing time and materials, the latter through stockpiling or natural occurrence (Torrence 1983 in Thacker 1996; Nelson 1991).

While expedience might have occurred in the late Pleistocene, it seems unlikely to have been the primary strategy in view of the apparent concern with raw material conservation. Carefully planned flaking of quartz from curated single platform bladelet cores would have been conducted first, followed by expedient bipolar flaking, aimed solely at maximising flake production. During the nonmicrolithic period quartz is likely to have been treated in the same way, although initial reduction would have proceeded via different techniques. Other raw materials may have been flaked more expediently.

Through the mid-Holocene the increased use of fine-grained stone, and the desire to make tools of it, must indicate curation of these materials, possibly over long distances. In general, retouched tools were more sophisticated and finely crafted during this time, suggesting longer periods of curation than before (Bamforth 1986), especially in the absence of large quantities of fine-grained materials.

The third strategy, opportunistic behaviour, seems most evident in some of the more recent Elands Bay assemblages. It is quite different, with no planning being involved and artefacts

reflecting merely a response to whatever needs present themselves at any place or time. This strategy overlaps with expedience since both rely on tools made as and when needed (Nelson 1991). The informality of most recent assemblages lends them to this interpretation.

At DFM 1 a very different situation existed, with curation of raw materials, perhaps from much further afield, having been necessary. The flaking seems expedient though, with the people obviously having planned a very specific activity for that time and place. Many of the backed bladelets were discarded on site, but the mastic traces occasionally present (Orton 1998) suggest that at least some were taken away hafted when the people left. Although insignificant evidence exists to make a clear judgement, similar behaviour may have occurred at PKM during the late Holocene.

8.5 RAW MATERIAL SELECTION.

Raw material selection in the Elands Bay area, as elsewhere, is primarily a function of the relative availability of workable stone. Second to this, one finds a complex interplay of lesser factors, such as technological and tool type requirements, cultural preferences, style and mobility, while many other minor factors probably remain to be discovered. The relative contributions of these factors are expected to have changed significantly through the millennia, but are unlikely to be completely dissociable. At Elands Bay the ubiquitous availability of workable quartz has undoubtedly determined its extreme dominance throughout most of the LSA, with rather less input from other factors. High quality materials such as silcrete and CCS, which maintain very low frequencies, are probably more strongly controlled by factors such as mobility and technological requirements, while poorer quality materials may well owe their presence simply to the expedient production of a stone flake to perform just a single task.

In very general terms the contribution of stone availability to raw material frequency is probably quantifiable by the minimum frequency of that material in any given period of time. In the current assemblage sample the minimum frequency of quartz is approximately 55%. Therefore, we can assume that in all assemblages at least 55% of quartz was selected for its suitability to artefact manufacture, and its easy accessibility. If just the late Holocene is considered, this frequency rises to about 77%. The remaining difference over and above the minimum frequency would then be attributable to the lesser factors noted above.

8.6 HUNTER-GATHERER AND HERDER LITHICS

Traditionally, hunter-gatherer sites are thought to contain fewer potsherds, and domestic animal bones than pastoralist sites and more diverse lithic assemblages with greater formal tool frequencies (Smith *et al.* 1991), but recently Sadr *et al.* (2003) have pointed out that these distinctions, at least at Kasteelberg, may not be as clear as had been thought. At Elands Bay, sites containing small numbers of domestic stock (Klein & Cruz-Urbe 1987), occasional potsherds and impoverished stone assemblages can all be found. Importantly though, these traits are seldom found together. DFM 1, for example, contains some 1100 potsherds (Stewart, pers. comm.), the remains of at least 4 sheep (Klein, pers. comm.), and a massive lithic assemblage with a high formal tool frequency. On the basis of the presence of dog gnawing on many bones from DFM 1, Klein (pers. comm.) considers the site to be pastoralist. Although dog and jackal gnawing cannot be readily distinguished, he considers the extreme rarity of this phenomenon before 2000 BP to suggest that domestic dogs were the most likely agents responsible. Stewart (pers. comm.) meanwhile argues that the tremendous range in pottery styles present on the site is very uncharacteristic of pastoralist people, and more likely reflects hunter-gatherer presence. The lithics also seem far more characteristic of a hunter-gatherer assemblage. HSM has no sheep (Klein & Cruz-Urbe 1987), 160 potsherds

from a small excavation (Noli 1988) with many more on the surface and an informal lithic assemblage with no formal tools. The LSA levels at Diepkloof Rockshelter contain 227 potsherds, very few LSA tools and at least 10 sheep (Parkington & Poggenpoel 1987), possibly representing the closest thing to a herder occupation in the western Cape area. Even this, though, pales into insignificance when considered alongside the classic pastoralist site of Kasteelberg D which contains some 574 potsherds, over 1000 domestic animal bones and just 150 stone artefacts (Sadr *et al.* 2003).

Historical records suggest pastoralists to have moved camp frequently, taking all their possessions with them (Robertshaw 1979). As such, their sites should not be easy to find, and most post-2000 BP archaeological sites might be expected, therefore, to be the remains of hunter-gatherer camps. This logic, considered along with the mixed archaeological signatures mentioned above, suggests that it is indeed very difficult, if not impossible to reliably assign hunter-gatherer or herder status to most, if not all, recent Elands Bay sites. This lends support to the contentions of Sadr *et al.* (2003) that the two economies may not be readily distinguished by their material remains, let alone just the lithic assemblages.

8.7 EVIDENCE FOR AGGREGATION AND DISPERSAL

Here I consider the suitability of the Elands Bay lithic assemblages to the assignation of aggregation or dispersal status to the sites. Aggregation and dispersal phases are not yet recognised for the late Pleistocene and it seems difficult to identify them around the Pleistocene/Holocene transition, but later Holocene sites are easier to deal with (Mitchell 2002b). Wadley (1987) has proposed that aggregation sites would likely contain a larger array of raw materials and tool types than dispersal sites, with the latter focussing on

expedient flaking of local raw materials. Special purpose sites, however, can look like dispersal sites, although high formal tool frequencies may be found on them.

Working at Jubilee Shelter, Wadley (1987) maintained that the higher frequency of flakes and lower frequency of cores in 'black rocks' than in quartz suggests that these black rocks were mostly flaked elsewhere, with the curated flakes being brought to the site during aggregation. Since Wadley states that nearby dykes and altered country rocks are important sources of these materials, I would see the most logical explanation being simply that black rocks came in larger pieces allowing the production of many more flakes per core. Despite a considerably poorer raw material outlook when compared to Wadley's research area, a similar pattern is in evidence at Elands Bay. It is well-known that quartz is best worked via bipolar flaking, which results in fewer flakes per core. Wadley's data are therefore neither surprising, nor unexpected. On this basis I suggest that no lithic evidence for aggregation and dispersal exists at Elands Bay. Overall, raw material variety is generally slightly greater at EBC, the obvious choice for an aggregation site in the area, but no differences on the scale noted by Wadley (1987) are apparent - a clear result of the relative availability of different rocks.

The Elands Bay sites generally contain relatively impoverished formal tool assemblages, in terms of both range of types and frequency. This is probably mainly due to the fact that quartz prevails throughout, thus blurring any effect that aggregation may cause. PKM is a small semi-open rockshelter with non-lithic remains indicating more intense occupation around 3000 to 2600 years ago (Jerardino 1998). Although very high formal tool frequencies occur at this time (Figure 5.38), it seems highly unlikely that this site represents either an

aggregation or a special purpose camp. DFM 1, with the only other unusually high tool frequency, has an extremely limited range of tools suggesting it to be a special purpose site.

While it is clear that all remains need to be considered, the lithics from Elands Bay suggest that stone artefacts alone are not good indicators of aggregation or dispersal, although it is recognised that inland patterns may be clearer than those at coastal sites.

8.8 RAW MATERIAL IDENTIFICATION

In Section 3.3.1 it was noted that certain rock types are difficult to classify in hand specimen. In view of this, the value of raw material identification must be questioned. This issue is not new (Pettigrew 1977:75), but has yet to be resolved. Should archaeological classifications of raw materials exist or should we follow strictly the terms and definitions used by geologists? An attempt has been made in this work to correctly identify all raw materials, although, in the absence of thin sectioning, errors certainly still exist. Following this research, two recommendations can be made:

1. Qualified geological expertise should be sought from time to time in order that a level of accuracy and consistency might be maintained during classification, since improved accuracy of classification can provide insight into various raw material issues, such as quality (cf. sandstone vs. quartzite) and sourcing (especially in the 'other' and FGB rock categories); and
2. Current geological terminology should replace the outdated terms used in archaeological research, since the interdisciplinary nature of archaeology makes it imperative that researchers are talking the same language.

8.9 FUTURE RESEARCH DIRECTIONS

In similar regional lithic studies performed in the future, it would be useful to bear in mind from the start how many sites and artefacts could eventually be included in the research. This project has shown that regional surveys following similar lines should include enough assemblages with reasonable numbers of artefacts in each period to enable as many reliable and significant results as possible to be obtained from the statistics. Although some good results were obtained with the current set of assemblages, it is certain that some patterns would have been far clearer and that others would have emerged had it been possible to include more sites in the research. Future work on similar topics might profit by focussing on just one of the periods under review here and including a broader array of sites from a wider geographical area. When designing a fieldwork strategy, consideration should be given to whether samples suitable for analysis will be obtained. Small samples can inform on what was present at a site, but detailed characterisation of the industry is difficult without large samples. The problem of incomparable chip frequencies is certainly real, and future analyses should take this into account so as to avoid spurious results.

Similarly detailed temporal analyses performed on other types of archaeological remains from the same sites would be most useful in aiding the interpretation of the lithic assemblages. At times, particular features were observed which could not be explained by the lithic evidence alone, and it is clear that input from faunal or other remains would help to clarify the situation. The opposite would no doubt also apply, with the lithics aiding interpretation of other finds. As such studies accumulate, a far more comprehensive picture of the local LSA sequence will be built up. The forthcoming work on Elands Bay Cave (Parkington, in prep.) is certainly a considerable step in that direction, but with a number of important inter-site differences (both highly specific and more general) being noted in the

current research, it is crucial that wider geographic foci are used in the compilation of regional syntheses.

I would encourage other lithic analysts to examine the various raw materials separately as has been done here, since it is clear that this technique allows more detailed information to be gleaned from lithic assemblages. This is likely to be most useful in the LSA and MSA, but even in ESA studies, where the focus is generally on only one or two materials, useful comparative information may well be obtained.

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