SBLS Lithic Technology and its Behavioural Implications

by

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DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

(Signature: Sebastian Bielderman)

On the 21st day of March 2024 at Johannesburg

ABSTRACT

In the Middle Stone Age (MSA) of the southern Cape in South Africa significant research has been undertaken to understand the behaviours linked to coastal adaptation as well as the exploitation of terrestrial resources, however but relatively little is understood on how lithic technology relates to human behaviour during certain MSA periods in this region. The Silty Black Soils (SBLS) layer at Klasies River main site (KRM), which is older than 110 000 years ago, falls within one of these lesser understood periods and has yielded lithic material in association with both faunal and shellfish remains and other important features such as hearths. Understanding the behaviours of the SBLS is significant in broadening our understanding of the MSA I/earlier MSA technologies. Through the analysis of the *Chaîne Opératoire* (or production sequence), macro-fractures, and the Tip Cross-Sectional Area of the SBLS lithics, significant information on the manufacturing and utilisation behaviours has been inferred. The data gained from these analyses allow for widespread behavioural comparison between the SBLS, overlaying KRM layers, and other sites. Broadly speaking, the assemblage shares several technological signatures with the MSA I/Klasies River technology previously identified at KRM and on a technological attribute level widespread similarities are shared with several MIS 5 assemblages in South Africa; an example of this is the widespread use of locally available raw materials. There is, however, a key behavioural inference which clearly indicates that the SBLS is different to other assemblages both at KRM and in the broader MIS 5. The SBLS points and their TCSA values point towards significantly smaller points. This supports a different and varied hunting approach which is unique to KRM during this period at KRM.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

The Middle Stone Age (MSA) in southern Africa is argued to be an important period in the development of both the material culture and the behaviour of *Homo sapiens.* The ever ubiquitous lithic material left behind by our *Homo sapiens* ancestors continues to provide insights into past behaviours and decision making (Soressi & Geneste 2011; Muller *et al.* 2017; Blackwood & Wilkins 2022). At Klasies River main site (KRM), the technology of a sample of the older than 110 000 years old (ka) lithic material of the Silty Black Soils (SBLS) layer stands out in relation to the younger MIS 5c-d layers (Wurz *et al.* 2018; Brenner & Wurz 2019; Brenner *et al.* 2022). Therefore, the study of the SBLS lithics has provided an important opportunity to gain insight into the past behavioural changes in the MSA during Marine Isotope Stage (MIS) 5d.

1.2 Research Question

Does the SBLS lithic material indicate significantly different lithic production, utilisation, and TCSA values relating to hunting behaviour compared to the later, overlying Shell Midden One (SMONE) and Black Occupational Soils (BOS) layers?

Hypothesis

Homo sapiens employed different lithic production, utilisation, and hunting behaviour during the SBLS occupation compared to the overlying SMONE and BOS layers.

1.3 Aims

- Analyse the technology of the SBLS lithics following Inizan *et al.* (1999), Sellet (1993) and Soressi and Geneste (2011).
- Undertake a Tip cross-sectional area (TCSA) analysis of the points from this layer, following Lombard (2021a).
- Conduct a macro-fracture analysis of all pointed artefacts and point fragments following Fischer *et al.* (1984) and Lombard (2005a) to infer use of the material.

1.4 Rationale

According to the analysis of lithics from several layers from square C1 at KRM (Brenner *et al.* 2022), the lowermost layer, the SBLS, has yielded the highest density of lithic material in comparison with the overlying material taken from Shell Midden One (SMONE), and Black Occupational Soils (BOS) One, Two, and Three. These layers are all associated with both faunal and shellfish material, although the shellfish is present in lower quantities in the SBLS when compared with these overlying layers. Brenner *et al.* (2022) report on small sample of the first SBLS lithics excavated and put forward that the material is smaller or shorter than those of the SMONE and BOS layers, and that no formal tools are present. TCSA analysis carried out by Lombard (2021a) on this small sample of the SBLS lithic material illustrates an anomaly when compared with other MIS 5 material of the MSA from the southern Cape. This assemblage indicates a proportionally larger presence of artefacts with dimensions similar to light-weight javelin, arrow, or dart tips, whereas the TCSA dimensions of roughly contemporaneous assemblages are dominated by points conforming ballistically to thrusting/stabbing spear tips (Lombard 2021a; Lombard & Shea 2021). Added to the differences in lithic morphology and density, as well as differing shellfish densities from other layers, this may indicate a change in the site usage and subsistence at KRM during this period.

Further analysis of the lithics from this layer is thus warranted as the previously analysed sample may not be representative of the larger SBLS layer as the material only comes from the upper few centimetres of a single square. A larger sample from SBLS, excavated in 2020, has been analysed to investigate further how *Homo sapiens* behaviour in this layer compares to the overlying layers SMONE and BOS (One, Two and Three) (cf. Wurz *et al.* 2018; Lap 2020; Oberholzer 2021). The lighter 'toolkit' which has been discussed by Brenner *et al.* (2022) may indicate that *Homo sapiens* hunted potentially different prey in a different manner, thus indicating different behavioural and subsistence strategies compared to the younger layers. This is of interest, as it is widely hypothesised that coastal adaptation became established in the southern Cape by 110 000 years ago (Will *et al.* 2019). However, the lithic technology and hunting behaviour during this specific period is not clearly understood. The SBLS falls within this period and provides an ideal opportunity to undertake an in-depth and detailed analysis of a vital period in the southern Cape coast.

1.5 Organisation of the dissertation

This dissertation consists of six chapters. This current chapter is chapter one and consists of a brief introduction, as well as the research question and hypothesis, and rationale for the study. This is followed by the literature review (chapter two) which covers an overview of the excavations and research undertaken at KRM as well as background to MSA lithics in southern Africa and the theoretical foundations of the methodologies employed in this study. Chapter three provides the details on the background of the study sample and the various methodologies that have been employed. Chapter four consists of the results obtained from the analysis of the study sample. Finally, chapter five sets out the discussion on the SBLS lithics in this study sample followed by chapter six which is a conclusion to the dissertation and the answer to the research question and hypothesis.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The Middle Stone Age is a temporal period that falls between the Earlier Stone Age (ESA) and Later Stone Age (LSA) in Africa south of the Sahara. The term was definitively described and then used by Goodwin and van Riet Lowe in 1929 as part of a move towards terminology and a Stone Age sequence that was not entirely informed by the European Palaeolithic (Goodwin & van Riet Lowe 1929; Goodwin 1946; Underhill 2011; Bicho 2021). Currently at this point in time, the starting and ending dates for any of the Stone Age periods in sub-Saharan Africa overlap temporally due to stone tool technology being widely distributed geographically while both the relative and absolute dates retrieved from Stone Age sites seem to indicate broad periods where the periods may have begun or come to an end (Wadley 2015; Wurz 2018). Many approximate dates have been provided for this period, however, there is some consensus that the MSA began somewhere around 300 ka (Lombard *et al.* 2012; Wadley 2015; Wurz 2019; Blackwood & Wilkins 2022; Lombard *et al.* 2022a), which broadly coincides with MIS 8 and comes to an end somewhere between 40 ka (Blackwood & Wilkins 2022) and 30 ka (Lombard *et al.* 2022a), coinciding with MIS 3 (Wurz 2019).

The coastal southern Cape of South Africa has provided several sites that form part of MSA research into past *Homo* subsistence behaviour, continued evolution of complex and innovative behaviour and the palaeoenvironment. KRM shares the Greater Cape Floristic region's archaeological landscape with Blombos Cave (BBC), Klipdrift Shelter (KDS), Pinnacle Point (PP), Die Kelders (DK) and Diepkloof Rockshelter (DRS) (Reynard & Wurz 2020).

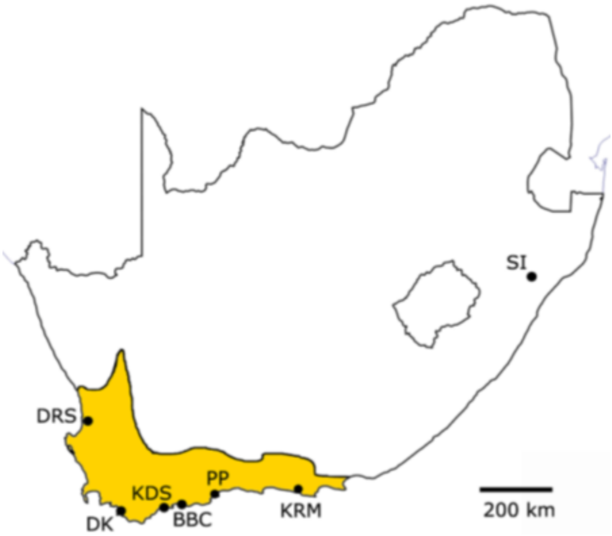


Figure 2.1 Map of the Greater Cape Floristic region which contains several southern and western Cape MSA sites (Reynard & Wurz 2020).

The SBLS material forms part of a diverse assemblage that has been uncovered at KRM over the last number of decades. KRM provides evidence of occupation over a 70-thousand-year period and has provided important insights into the cognition, technology, behaviours, and world of *Homo sapiens*. These insights have been studied through the material record consisting of faunal remains and marine resources, the lithics, plant material and the remains of *Homo sapiens* themselves. The SBLS lithics fall within the MIS 5d-e and is older than 110 000 years ago (ka) (Wurz *et al.* 2022). This chapter seeks to situate the SBLS lithic material from KRM within the current understanding of lithic technology and usage at both KRM as well as the wider southern Cape in this time period and provide background on the theoretical and methodological aspects of this study.

2.2 What is lithic MSA technology in southern Africa?

Much like the ESA, the ever-ubiquitous MSA stone artefacts are part of the better preserving tools that the MSA humans relied on. MSA lithic assemblages are characterised by the absence of large cutting tools that were a hallmark of the Acheulean and Acheulean-like technocomplexes of the ESA, and the widespread presence of prepared core technologies (Bicho 2021). MSA lithic technology is represented by a variety of assemblages that are spread widely across southern Africa both temporally and spatially (Bicho 2021). This lithic technology is based on detaching flakes such as convergent points, blades and bladelets from the prepared cores, following which these flakes were worked into tools that were used for a variety of activities (Bader *et al.* 2022a). Prepared core technologies include the *Levallois*, bipolar, discoid, inclined, platform, parallel, blade, Kombewa, and proto- or para-*Levallois* technologies (Inizan *et al.* 1999; Conard *et al.* 2004; Wurz 2013; Chazan 2014; Wurz 2018; Bader *et al.* 2022a).

These prepared core types embody predetermined *debitage* (Inizan *et al.* 1999). As there is a clear and deliberate effort to manufacture particular flakes, particular core shapes become apparent. This is simply due to each method being defined by the specific conceptual and operative schemes on how flakes are removed from particular volumetric conceptions of the core which differ from one method to the next. Three distinct methods are discussed below to provide a general understanding of prepared core technology and how they are understood by researchers who analyse them. These methods are the *Levallois*, Kombewa, and blade core types (following Inizan *et al.* 1999) and are viewed as being among the most widespread, while also being the most characteristic or possibly the best documented at this stage.

The *Levallois* technique, first discovered as early as 1867 in a Parisian suburb of the same name and first reassembled by Victor Commont in 1909 (Inizan *et al.* 1999), is one of the intricate prepared core techniques employed by hominins in the manufacture of lithic material (Chazan 2014) and is suggested to be the most well-known (Bader *et al.* 2022a). In 1961, François Bordes described the technique as the manufacture of a "flake of a form predetermined by special preparation of the core prior to the removal of that flake" (Bordes 1961). The *Levallois* technique is present for around half a million years and it appears on every inhabited continent except the Americas (Inizan *et al.* 1999). However, this does raise several problems with its description and classification. There has been an effort to address these problems, principally by Boëda (1994) in their research on the Middle Palaeolithic of Northern France, by providing a broadened definition for the *Levallois* approach. This, firstly, meant expanding the definition away from insisting on centripetal preparation of the core as it is not a constant feature. Secondly, platform preparation of the single preferential flake had been prioritised which left the approach too analytically 'narrow' as it did not account for other preparation methods that involve more than one preferential flake which is also present within the *Levallois* and therefore this had to be expanded. Finally, the approach had been largely described using terminology that described the morphological characteristics of the end-products of the knapping process (for example, blade, point or flake), therefore a different approach was suggested, following Tixier (1967), that saw three key concepts clearly defined: concept, technique and method (Boëda 1988). This allowed for the morphological variation of *Levallois* technology to be better understood.

To follow the *Levallois* methods, the core must first have two opposing surfaces prepared. The first being the lower surface which would function as the striking platform used to remove flakes from the core, and the second being the upper surface on which the flakes would be removed. These flake removals are first the preparatory flake removals, followed by the removal of the 'end-product' which is the preferential flake. *Levallois* relies on this volumetric conception of the core and process of flake removal to constitute what is regarded as the *Levallois* 'concept'. Removal of flakes, which is the technique, is characterised by the use of a hard stone hammer to strike the platform surface (Inizan *et al.* 1999). This platform surface (the striking surface) must be perpendicular (or at least close to an angle near to 90°) to the flaking surface so as to facilitate the flaking of a single surface within the *Levallois* approach (Boëda 1995; Bader *et al.* 2022a).

Levallois can be represented by two organisations of its reduction sequence, seen as the 'methods' (Boëda 1988; Inizan *et al.* 1999). The first involves following the "preferential method" where the upper surface is prepared and a single preferential flake is removed. Following this removal, the entire upper surface is reworked prior to the removal of another preferred flake (Boëda 1993, 1994; Bader *et al.* 2022a). The second method consists of what is referred to as 'recurrent methods', also referred to as 'multi-flake *debitage*', whereby a series of preferential flakes are removed before the prepared upper surface is reworked. These fall into the categories of: unidirectional, bidirectional, and centripetal which denotes the directionality of the multiple removals from the core (Inizan *et al.* 1999). This *Levallois* technology has been noted at both coastal sites (as discussed later) and in the South African interior at sites such as Bushman Rock Shelter where MIS 5 lithics display the recurrent *Levallois* method (Douze *et al.* 2020).

Understanding the intricacies of core reduction is central to understanding MSA technology. Many typologies and approaches to understanding core reduction have been applied within Stone Age research within southern Africa of the last number of decades. This has led to widespread differences on core terminology. Conard *et al.* (2004) provide a generalised taxonomy which includes initial, parallel, multidirectional, bipolar, and indeterminate broken. The unified taxonomy that the authors proposed was created to solve the problem of communication difficulties between Southern African and European archaeologists by creating a system which could be easily applied to all the Stone Ages and be broad enough to account for the majority of analysed cores. These categories can account for the inferred core reduction of at least 70 to 90% of analysed cores. These technological core categories have been used for identification within the southern African MSA as seen at KRM (Brenner *et al.* 2022).

Secondly, the Kombewa method is a method of predetermined *debitage* largely recognised in Africa (Inizan *et al.* 1999). However, it has been identified outside of the continent as well so it is not specifically attributed to the African Stone Age (see Beshkani *et al.* 2017). The method is believed to precede the emergence of the *Levallois* in Africa, however there is evidence that this method may date to the ESA (see Gallotti & Mussi 2018; Masojć *et al.* 2021). This is, again, a reminder that predetermined *debitage* or prepared core technology is not an invention of the MSA but an aspect of lithic technology which is also under constant change from the ESA into the MSA. It should also be noted that the Kombewa is not the only prepared core technology that currently dates to the ESA; the Victoria West technology studied in South Africa is also present (Li *et al.* 2017), however, it does not seem to persist in the same manner that the Kombewa does. Kombewa technology follows a fairly simple process. A large circular, semi-circular, or oval flake is struck from a convex active surface. Following this, the next step of the *debitage* takes place on the removed flake's ventral surface. The shape of the first flake as well as the convexity of the pronounced bulb of percussion allows for the shape of the second flake to be largely pre-planned. In terms of the removal of the second flake, a striking platform may be prepared but is not a requirement for the *debitage* to fall under this method, and the removal orientation of this second flake may be in any direction relative to the removal orientation of the first flake (Inizan *et al.* 1999).

Thirdly, blade *debitage* is another widespread and well researched prepared core method that appears in the MSA. Blade *debitage* refers to particular predetermined organisation of the actives surface(s) of the core with the explicit intention of removing blade or bladelets from the core (Inizan *et al.* 1999). This laminar production method has been regarded by many scholars to be a relatively sophisticated method of core preparation and lithic production (Schmid *et al.* 2019). The key characteristic of blade cores, and thus the presence of the blade reduction method, is the appearance of blade (or bladelet) scars parallel to one another on the active surface(s) of the core. Although the simple presence of the removal of laminar products is not the only requirement for a core to present the blade *debitage* method, the entire conception of blade *debitage* is different to the *Levallois* method. For instance, blade reduction can be undertaken using both direct hammer (Inizan *et al.* 1999; Bader *et al.* 2022a) and indirect hammer percussion (Inizan *et al.* 1999) where the difference in percussive approach seems to have more to do with the final outcome of the blade's (or bladelet's) morphology. Blade *debitage* relies heavily on the preparation of both a striking surface (or surfaces), as well as the shaping of the core. This shaping of the core may be bifacial so that a crest on the margin of the active surface can be created. This crest is then the first elongated piece that is removed and is referred to as a 'crested blade'. With the removal of this generally triangular blade, the laminar method of removing several pieces in a laminar and parallel manner is possible. Although the laminar technology of the blade reduction method is argued to dominate the Upper Palaeolithic in some regions, it is believed that this reduction method would have been possible in the Middle Palaeolithic (MP) and MSA (see Bar-Yosef & Kuhn 1999; Wilkins & Chazan 2012; Schmid *et al.* 2019) and this does seem to be supported by the many MSA and MP sites that are argued to have this technology (Inizan *et al.* 1999; Bader *et al.* 2022a).

Finally, other elements commonly said to be associated with the development of MSA lithics are heat treatment, bow and arrow technology which first appears during the Howiesons Poort

(Lombard & Phillipson 2010; Wadley 2013) and hafting to create spears and javelins (Chazan 2014; Bicho 2021; Bader *et al.* 2022a). Coastal Adaptation indicates expanded resource use which required more specialised tools, while tool assemblages seemed to develop greater variability than earlier periods.

2.3 KRM and its Stratigraphy

The depositional material at KRM has provided more than 21 metres of archeologically significant deposit and it has been excavated by three investigators (John Wymer, Hillary Deacon, and Sarah Wurz) through their respective research projects at KRM over the last 60 years. The site consists of several caves, namely: 1, 1A, 1B, 1C and 2 (Figure 2.2). Singer and Wymer undertook the first excavations at KRM between 1967 and 1968 (Singer & Wymer 1982). Their excavation took place in 4 of the features at KRM and resulted in the extensive removal of material. This was particularly true for Cave 1 (see Figure 2.3) where the extensive excavations led to the witness baulk being the only deposit that remained in the central part of the cave (Singer & Wymer 1982; Deacon & Geleijnse 1988; Morrissey *et al.* 2022).

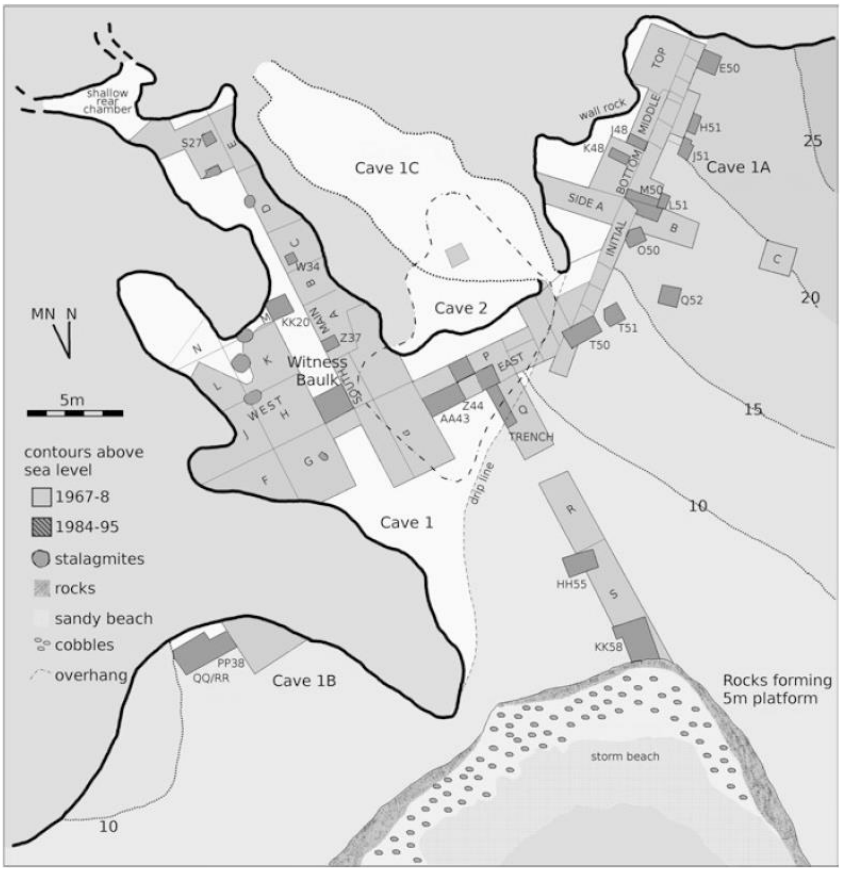


Figure 2.2. Map of the excavations undertaken at KRM. This map includes the work done by Deacon (taken from Wurz 2023).

Although excavation was conducted at a relatively low stratigraphic resolution with limited recording by modern standards, the excavation yielded significant MSA materials (Singer & Wymer 1982; Morrissey *et al.* 2022). The excavated deposits were separated into layers from Layer 1 to 40. The separation was based on perceived shifts in lithological characteristics of the excavated soil (Singer & Wymer 1982). The low stratigraphic resolution and, at times, limited detail used to describe the deposits led to the grouping of several layers with differing lithological characteristics (some of which were formed by different processes) together or, on the other hand, having other layers separated despite being described as having similar characteristics or possessing the same cultural material (Singer & Wymer 1982; Deacon & Geleijnse 1988; Morrissey *et al.* 2022).

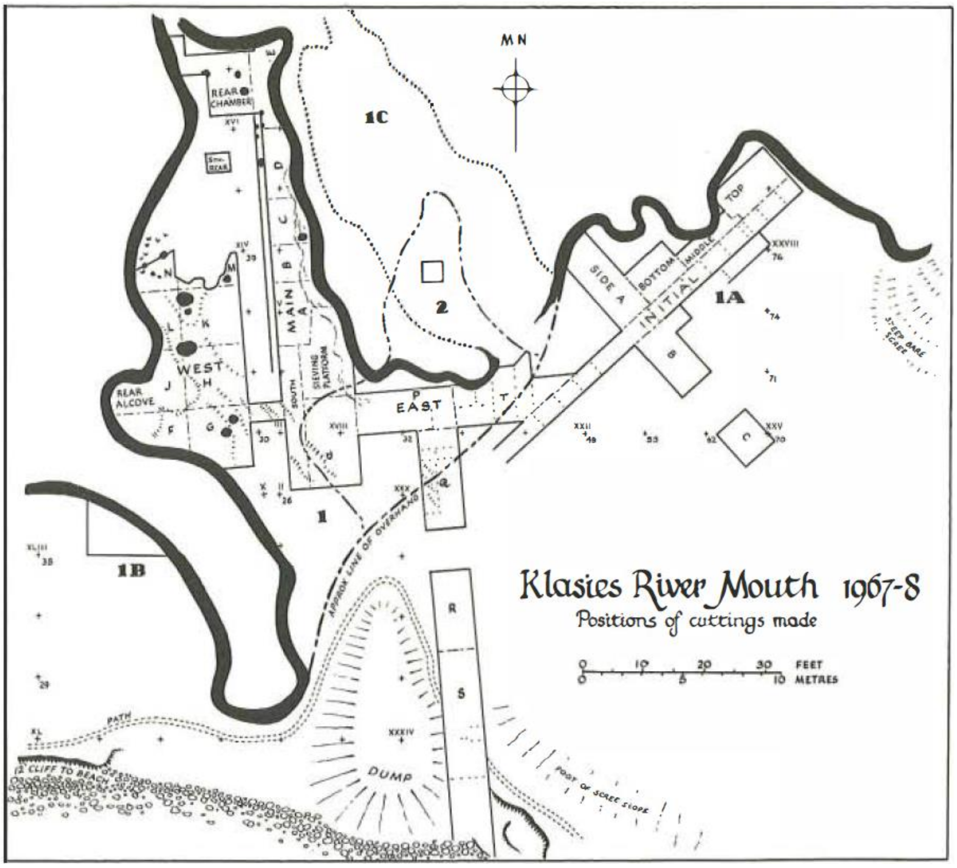


Figure 2.3. Map of the Singer & Wymer excavations (taken from Singer & Wymer 1982).

The deposits at KRM encompass both the LSA and the MSA (Singer & Wymer 1982). The layers attributed to the MSA from the excavation were separated into five chronological phases (also referred to as stages or industries) being the MSA I, MSA II, Howiesons Poort (HP), MSA III and MSA IV (Singer & Wymer 1982; Deacon & Geleijnse 1988; Wurz 2023). Stratigraphic correlations between the caves at Main site were also based on this cultural stratigraphy derived from the lithic technology.

In the 1980s Deacon began excavations at KRM (Figure 2.3). Deacon undertook high-resolution stratigraphic work, however it was not extensively published before his passing (Morrissey *et al.* 2022). Therefore, the data on the KRM stratigraphy from his excavation is somewhat limited. Nonetheless, the published high-resolution work by Deacon indicates substantially more layers than previous stratigraphic analysis. These layers were divided into members and sub-members derived from the lithological characteristics of the deposit (Deacon & Geleijnse 1988). In Cave 1 specifically relating to the witness baulk these members were labelled as: Light Brown Sand (LBS), Rubble Brown Sand (RBS), Shell and Sand (SAS), and White Sand (WS) (see Figure 2.4).

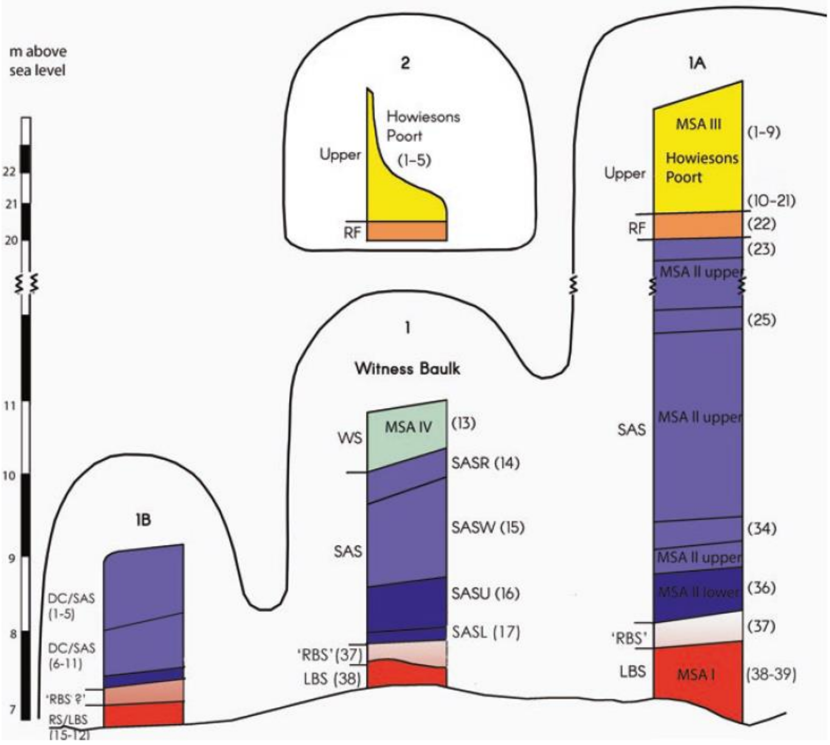


Figure 2.4 Stratigraphy of KRM indicating the Deacon members with the Singer and Wymer layers in brackets (taken from Wurz 2023).

Through the continued stratigraphical work at KRM, it has become clear that the site has a complex, and somewhat complicated, depositional history (Deacon & Geleijnse 1988; Morrissey *et al.* 2022; Wurz 2023). There is clear evidence of cycles of deposition, erosion, truncation, and disturbance (Deacon & Geleijnse 1988; Morrissey *et al.* 2022). At this point in time, stratigraphic links that have been made between the deposits in various caves at KRM are still understood through lithic technology as originally done by Singer and Wymer. Further geoarchaeological work to understand the relationships between deposits in several caves (for example, Cave 1, 1A, and 1B) is currently underway where Morrissey *et al.* (2022) is the first iteration of this work.

The most recent work has been carried out by Wurz beginning in 2015 focusing on the witness baulk from cave 1, a witness section of original deposit left by Wymer (Brenner *et al.* 2022). The most recent lithostratigraphic members and sub-members of the witness baulk to be excavated by Wurz has been the Shell and Sand Lower (SASL). The SMONE – BOS Three layers form part of the SASL sub-member. The Silty Black Soils (SBLS) layer is considered to be its own member, equivalent to Singer & Wymer's layer 37 (Morrissey *et al.* 2022; Wurz *et al.* 2022). Deacon initially considered the SBLS part of the deposits related to the Rubble Brown Sand (RBS) member but the geoarchaeological work indicates lesser quantities of rubble in this member, and therefore the RBS member designation has been changed to the SBLS member. The SBLS has been affected by several post-depositional processes which have added to the stratigraphic complications at KRM. The processes include a stalactite falling into the deposit some time in the past and coming to rest on the SBLS deposit, leading to its partial deformation (Wurz *et al.* 2022).

2.4 MIS 5 Technology

The lithic technocomplexes of the MSA of the southern Cape have been judged to fall under both the prepared core *Levallois* technology as well as core technology which is classed as non-*Levallois* (Chazan 2014; McCall & Taylor-Perryman 2014; Bader *et al.* 2022a). KRM lithic technology generally consists of points and blades with substantial variability (Wurz 2013) which have been specifically described by three authors who have studied the material. Singer and Wymer (1982), Volman (1981) and Wurz (2000; 2002) have provided names for the lithic record of KRM. Singer and Wymer (1982) elected to use the terms MSA I, MSA II, Howiesons Poort (HP), MSA III and MSA IV to describe the phases of MSA technology as Industries. Volman (1981) made use of MSA 2a, 2b, Howiesons Poort (HP), and Post-Howiesons Poort. Finally, Wurz (2002) employed new terms to describe the specific sub-stages as seen from the KRM assemblages. These are Klasies River, Mossel Bay, Howiesons Poort (HP), and Post Howiesons Poort. Singer and Wymer's terms are still widely used as they are the original labels (Wurz 2002; Brenner & Wurz 2019), however the other terms are used interchangeably at times. Again, these terms are described below:

Table 1. The names of the lithic groupings of KRM employed by several authors.

Singer & Wymer (1982)	**Volman (1981)**	**Wurz (2002)**	**Dating** (Lombard *et al.* 2012, 2022a)
MSA I	MSA 2a	Klasies River	130-105 kya (MIS 5e-d), 90 kya, 110 kya, 106.8 ± 12.6 kya, 108.6 ± 3.4 kya
MSA II	MSA 2b	Mossel Bay / Still Bay	105-77 kya (MIS 5a-4), 66.4 ± 6.1 kya, 77.4 ± 7.0 kya 85 ± 8 kya / 77-70 kya (MIS 5a-4)
Howiesons Poort	Howiesons Poort	Howiesons Poort	66-58 kya (MIS 4-3), 52.4 ± 4.0 kyya, 63.3 ± 2.9 kya 66.9 ± 3.3 kya
MSA III & IV	Post-Howiesons Poort	Post-Howiesons Poort	58 – 45 kya (MIS 3), 56.3 ± 4.6 kya, 65 kya, 66.5 ± 4.8 kya, 70.7 ± 7.4 kya

Although the SBLS material has now been placed with the Klasies River (MSA I) industry (Wurz *et al* 2022), both MSA I and II are discussed below as it is important to distinguish between the two lithic entities as differences are not well understood at this stage. Finally, as the Klasies River industry has been considered to possess the same characteristics as the Howiesons Poort technocomplex (Wurz 2010), this technology is also discussed below with a focus on the similarities.

2.4.1 The MSA I (Klasies River industry) at KRM

The SBLS is associated with the Klasies River Industry. The widespread appearance of an identical and specific 'MSA I' technology at several sites is not widely reported (unlike the MSA II). Therefore, this dissertation focuses on the MSA I/Klasies River specific to KRM as wider comparison remains limited. At KRM the industry has had several dates attributed to it. Two absolute dates provided for KRM are 106.8 ± 12.6 ka and 108.6 ± 3.4 ka (Lombard *et al.* 2012, 2022a; Morrissey *et al.* 2022), though broader dates of 130-105 ka have also been published (Wurz 2012). The overlying BOS Three member is older than 110 ka (Wurz *et al.* 2022), indicating that the MSA l must be older than this age.

The Klasies River industry can be understood through the *Chaîne Opératoire* (see Sellet 1993; Wurz 2000; Oberholzer 2021) as will be employed in this study. Raw material selection is overwhelming, locally sourced as 99% of the excavated assemblages at KRM are quartzite, sourced from locally available cobbles (Wurz 2002, 2012), whereas the remaining 1% has been generally referred to as non-local, fine-grained material. This non-local raw material includes silcrete, quartz, chalcedony and hornfels (Wurz 2000), although in previous studies these materials have been lumped together and it is not clear what the quantities of each rock type is. Core reduction frequently involved a single convex production surface following a laminar reduction system, where this convex shape of the surface was maintained through smaller removals (Wurz 2000, 2012). The cores were also shaped through the removal of 'thick-sectioned' blades or *Débordant* (core edge flakes), where these thick-sectioned blades sometimes have a geometric profile which is twisted. The reduction aimed to remove relative thin, curved, elongated points and blades as a final product (Wurz 2002, 2012).

Wurz (2002) reports that some 'end-stage' cores can be interpreted as evidence of the Levallois point core method, which is argued to co-exist alongside the more dominant laminar method of reduction. Of the identifiable cores, 35% were classified as 'point cores' as opposed to the 18% identified as blade cores, however the extensive working of blade cores can end with the removal of a point. These cores have also been referred to as 'two volume cores' by Wurz (2012), following Conard *et al.* (2004). The platforms of the products made in this industry were sometimes prepared through rubbing and the platforms are dominated by facetted or plain morphologies. Both soft hammer (seen through weak bulbs and small platform areas) and hard hammer (seen through prominent bulbs and thick platform areas) techniques have been inferred. Finally, retouch on the Klasies River material is very limited as notched pieces and retouched blades and points occur in small numbers. Denticulation has also only been noted on a small number of lithics by Wurz, but several authors originally suggested that denticulated pieces are a characteristic of the MSA I (MSA 2a) (Singer & Wymer 1982; Volman 1984).

Some of the end products exhibit similar characteristics to those of the HP technocomplex, namely the presence of bidirectional blade cores, the curved blades that have platforms with evidence of rubbing, the removal of small flakes for platform shaping, and diffused bulbs of percussion (Wurz 2010, 2013).

2.4.2 The MSA II (Mossel Bay) at KRM and other southern Cape sites

The MSA II/Mossel Bay is described here, as it is the technocomplex that follows the Klasies River at KRM and this will allow for confirmation of the SBLS sample's final designation. The name MSA II is preliminarily used in this dissertation to facilitate wider comparison with several other sites that have a presence of the same technology. Many absolute dates have been proposed from several sites that have been attributed to the MSA II/Mossel Bay. The MSA II broadly dates to 105-77 ka (Lombard *et al.* 2012, 2022a; Morrissey *et al.* 2022).

At KRM, the MSA II has been separated into 'upper' and 'lower' industries based on variability in the assemblage. This separation into upper and lower is based on the techno-typological attributes of the lithics. The lithics of the MSA II upper have been described as thinner and more regular, with the points being smaller in all their dimensions than the earlier material of the MSA II lower (Thackeray 1989; Wurz 2002; Brenner & Wurz 2019). The MSA II has been described as a point and blade technocomplex, however specifically in the KRM assemblage, points 'end products' dominate the recovered assemblages. A unidirectional convergent *Levallois* strategy of core preparation has been followed throughout the MSA II at KRM (Wurz 2012).

The MSA II involves the use of both fine and coarse-grained quartzite as the preferred raw material, as quartzite lithics usually make up 80-90% of the recovered material from KRM (Wurz 2000; Wurz 2002; Brenner & Wurz 2019). The other raw materials were sourced in low quantities (on average around 1% or less) from fine-grained materials such as hornfels and silcrete while the balance of the coarse-grained material is quartz and sandstone (Wurz 2012; Brenner & Wurz 2019). Wurz (2002) describes much of the material as being locally sourced. This is especially true for the dominating quartzite material. The method of core reduction at KRM seems to begin with the splitting of cobbles (with regard to the majority of the material coming from cobble/pebble cores) through a bipolar reduction method (Brenner & Wurz 2019), followed by the removal of core edge flakes as well as other core edge pieces from the core blank. This was done to create the proximal striking platform from which flakes were removed in either a unidirectional (unipolar) parallel or convergent manner. The convergent reduction, caused by flakes that are struck in a manner that converge towards the distal end of the core to create a point, is important at KRM as points dominate. The bulb of percussion and the morphology of the platform are also important markers for the technique of flake removal. The MSA II platforms have been described in previous research as either plain or faceted (Wurz

2000, 2002) while the bulb of percussion is viewed as prominent. The bulbs of percussion are accompanied by ring cracks which has been argued to indicate the use of a hard hammer for flake removal (Wurz 2002). Finally, utilisation has been assessed by identifying two potential forms of retouch. These forms are informal and formal retouch (Wurz 2000; Brenner & Wurz 2019). Informal retouch has been inferred as possible use-wear damage that is generally recognised as dulled edges whereas, formal retouch is viewed as the intentional reworking, or reforming, of tool edges through flaking, notching and denticulation. Formal retouch through knapping is argued to be limited at KRM in the MSA II, however, in cases where it is present, it seems to be localised to the proximal and distal ends of points presumably to resharpen the tools, or the reworking of the proximal (platform) end. The reworking of the platform ends seems to be intended for thinning the area and has been interpreted as potential indirect evidence for the practice of hafting lithics (Wurz 2012). The indirect evidence of hafting has led to inferences that MSA II lithics may have been used as hunting implements (Wurz 2012).

2.4.3 The Howiesons Poort

The Howiesons Poort (HP) technocomplex was first recognised by Goodwin and van Riet Lowe (1929) and is one of the better known and researched technologies of the southern African MSA (Bader *et al.* 2022a). It is specifically associated with backed geometric artefacts and the presence of blade technology (Lombard *et al.* 2012; Wurz 2021). The technology is widespread and has been identified at more than 20 sites south of the Zambezi river (Lombard 2005b, 2009; Henshilwood 2012; Wurz 2013). These sites are found in a diversity of regions, occurring in three southern African countries: South Africa, Namibia and Lesotho. Klasies River main site is among these sites.

Thanks to the distinctiveness of the geometric backed artefacts, the industry has served as horizon marker for the MSA of Southern Africa (Deacon 1992; Wurz 2013) for decades and the technology has been widely regarded as possessing an ‘Upper Palaeolithic’ complexity (Wurz 2002) due to the presence of blade technology and geometric backed artefacts, sometimes referred to as ‘microliths’. Two approaches to the dating of the HP have been published. The first being that the technocomplex was a short-lived technology which occurred within clear temporal boundaries. Eight sites have single-grain Optically Stimulated Luminescence (OSL) dates of between 64,800 and 59,500 years ago (Jacobs *et al.* 2008; Cochrane *et al.* 2013; Wurz 2013). A similar period of around 66,000 to 58,000 years ago has also been published (Lombard *et al.* 2012; Bader *et al.* 2022a; Lombard *et al.* 2022a). However, this proposition is not without its criticism.

The second chronology makes use of both OSL and Thermoluminescence (TL) dating at Diepkloof Rock Shelter and proposes much broader date range for the HP (Tribolo *et al.* 2009, 2013; Bader *et al.* 2022a).

Originally, Tribolo *et al.* (2009) estimated that the HP started at around 93,000 ± 8,000 years ago, following the change from the Still Bay technocomplex. Further work at Diepkloof Rock Shelter has split the HP into early, intermediate and late (Porraz *et al.* 2013; Tribolo *et al.* 2013). Of interest here are the early dates for the 'early Howiesons Poort'. This 'early Howiesons Poort' has been dated, using two samples, to 109,000 and 105,000 ± 10,000 years ago. However, at this point it is important to note that these older dates for HP material are yet to be reproduced or confirmed at other southern African sites (Bader *et al.* 2022a), although they do seem to raise interesting questions for both the Howiesons Poort and the MSA I/Klasies River considering the morphological similarities and the later dates that are contemporaneous with the SBLS.

Following the *chaîne opératoire*, the raw material selection of the Howiesons Poort sees a large increase in the usage of non-local, non-quartzite material particularly when compared with the MSA I/Klasies River and MSA II at KRM (Wurz 2000; 2002). The two previously analysed Howiesons Poort samples from KRM report non-local usage between 26% and 33% of the respective samples, with silcrete forming a majority of non-local material (Wurz 2002; Villa *et al.* 2010), which is an incredible increase when compared to earlier industries at KRM. This has indicated that a different procurement strategy has been implemented. The technique of production of the KRM HP indicates a presence of platforms that have been described as small and plain, with lipping present on the platforms. The exterior platform angle has been seen as high. The lipping, presence of diffused bulbs of percussion, and high platform angle indicate the use of a soft hammer; possibly like wood (Wurz 2000; 2002). Unlike the technology predating it at KRM, the platform angle from the dorsal surface ranges from 50º to 70º. Platform preparation appears in two forms: rubbing and step flaking of the dorsal edge of the platform. Both are localised close to the platform. These steps were taken with the explicit goal of removing elongated blade products (Wurz 2002).

The core preparation followed a similar method to that of the Klasies River industry (Wurz 2000). The reduction approach is classified as non-*Levallois* due to the intersection of the reduction surface and 'nonproduction' surface not possessing the plane of intersection as seen in *Levallois* technology (Villa *et al.* 2010; Porraz *et al.* 2013). The convexities of the surfaces are also interpreted as being more pronounced at the beginning of the reduction as opposed to later phases of the reduction of the core (Wurz 2013). It should be noted that earlier work at KRM concluded that quartzite and non-quartzite cores underwent the exact same reduction strategies as no conceptual differences were identified. The non-quartzite cores appearing thinner and shorter than the quartzite cores is explained as evidence for non-quartzite (silcrete) cores undergoing a greater degree of reduction as the finer grained silcrete could be worked more extensively (Wurz 2000: 185; 2002; Villa *et al.* 2010). The initial morphology of the core has been described as conical at KRM, and continued reduction of the core created the more rectangular core form present at later phases in the reduction sequence. The preparation of the reduction surface involved the removal of flat bladelets from the outer margins of the core, which allowed the convexity to be retained. Finally, distal platforms are frequently present on the cores, however, they are not ubiquitous (Wurz 2000).

Retouch has been recorded on the KRM material and appears as potentially informal notching (Wurz 2000). These have been specifically described at 'notched blades', with the appearance of 'wide notches' potentially indicating some form of wood working (Wurz 2002: 1009). In the original analysis of 131 of the 214 notched pieces present in the sample studied by Singer and Wymer (1982), it was indicated that the majority of notches appeared to be made on blades that were of non-local raw material (Wurz 2002). The backing of whole blades as segments is one of the well-established typological characteristics.

2.4.4 Other assemblage of the MIS 5 southern Africa

The southern Cape of South Africa contains several other sites which have provided substantial lithic material dating to the broader MIS 5. The purpose of this sub-section is to provide a brief introduction to lithic technology in the MIS 5 in southern Africa and provide a more extended background to the study of MIS 5 lithics, the technology that has been identified, and some problems with research on these assemblages that continue to plague regional and sub-continental studies.

Three of these assemblages have originally been assigned to the wider MSA I technology although these designations seem tentative due to the many limitations and difficulties with describing a secure cultural framework on the sub-continental scale. The term 'MSA I' is used throughout to avoid confusion although different authors have proposed varied forms of the same term. These sites are Elands Bay Cave (EBC), Peers Cave (PC) and Bushman Rock Shelter (BRS) (Schmid *et al.* 2016). These assemblages were originally assigned to a broad MSA I categorisation on the basis of technological similarities found in the assemblages and how these attributes were incorporated into Volman's conception of the chrono-cultural phases of the southern African MSA (Volman 1981, 1984).

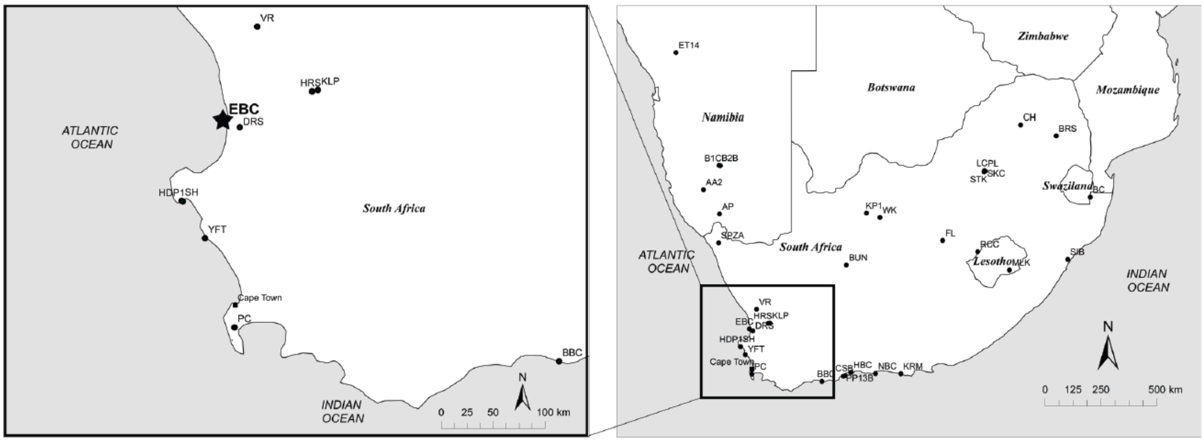


Figure 2.5 Maps of other sites in the southern Cape and southern Africa. The map identifies many MSA sites, however only related MIS 5 sites are discussed (taken from Schmid et al. 2016).

Both the PC and BRS assemblages that Volman (1981, 1984) described were undated at the time of his analysis and remain undated, however, the lower MSA of EBC has provided dates between 236 ka and 83 ka (Schmid *et al.* 2016). The assemblages at all three sites were attributed to the MSA I based on several attributes. The assemblages are dominated by local procurement (quartzite at PC and EBC, and quartz and hornfels at BRS), where the preferred end products are flakes. At PC and EBC the dominant platforms are plain or cortical and the low frequencies of tools in both assemblages are largely made up of notched and denticulated pieces (Schmid *et al.* 2016). The PC and EBC assemblages share core characteristics that could fall under the Planar-Orthogonal-Linear-reduction system suggested by Schmid *et al.* (2016), which is argued to be a defining characteristic of these assemblages' technology. Underhill (2012) reports the presence of notched and denticulated tools alongside side scrapers in BRS layers originally assigned to the MSA I, while the reduction strategy relies on unidirectional and platform cores. Although these assemblages share particular characteristics, their association with a broader MSA I seems tentative.

At DRS (in close proximity to EBC, see Figure 2.5), the MSA-Mike (or type 'Mike') assemblage has been dated to 107-11 ka and 100-10 ka (Porraz *et al.* 2013; Tribolo *et al.* 2013), and it is believed to share technological similarities with the lower depositional layers at KRM that related to the MSA I and MSA II. This is particularly true in the case of MSA II where frequently retouched *Levallois* points and the inferred use of hard hammer percussion are argued to be identifying characteristics (Porraz *et al.* (2013) following Wurz (2002)). This assemblage is dominated by locally procured raw materials as quartzite makes up more than 80% of the lithics, followed by quartz. The non-local portion of the assemblage is dominated by silcrete. Tools only make up 2% of the assemblage and tool types are dominated by notched and denticulated pieces (Porraz *et al.* 2013; Schmid *et al.* 2016).

Similarly, an assemblage from an open-air site at Duinefontein 2 in the Western Cape was originally categorised as part of the MSA I (Volman 1981, 1984), however further work by Klein *et al.* (1999) recognised the presence of later Acheulean material in the recovered lithics which has led to the assemblage being recognised as ESA technology. Furthermore, the MIS 6 assemblage at Pinnacle Point 13B (PP13B) has been linked to the MSA I (Thompson *et al.* 2010). Several similarities were identified including rare formally retouched tools, presence of plain platforms and the dominant usage of locally procured quartzite material. Although the assemblage was not more formally attributed to the MSA I due to substantial differences that include bladelet production (Thompson *et al.* 2010). Again, the point raised here is evidence for the limitations surrounding the study of the MSA I. The broad period attributed to this loosely defined industry and the lack of concrete dates for many assemblages has seen the MSA I compared with assemblages as old as the MIS 6. Therefore, beyond KRM and a handful of other assemblages, assessing the SBLS against a regional MSA I is difficult and limited. The MSA I is, however, not the only MIS 5 technology that has been recognised at several sites and has undergone varied comparisons with other regional industries. The Pietersburg industry is one such industry.

Mason (1962) formally described the Pietersburg industry through material retrieved from Cave of Hearths (CoH), and the industry was divided into three phases (the early, middle, and later Pietersburg). The original descriptions of the Pietersburg have been argued to be vague, leading to the technological coherence of the industry through time being problematic (de la Peña *et al.* 2019). Although these assemblages have not been absolutely dated, the industry is believed to be fairly widespread in the interior of South Africa (Oberholzer 2021). Some of these notable sites are Border Cave (BC) (Backwell et al. 2018), Olieboomspoort (OBP) (Val *et al.* 2021), Mwulu's Cave (MC) (de la Peña *et al.* 2019), and Bushman Rock shelter (BRS) (Porraz *et al.* 2018). Several dates have been provided by different materials at BRS. The upper two phases have been dated on quartz (73 ± 6 ka and 75 ± 6 ka) and feldspar (91 ± 10 ka and 97 ± 10 ka) (Porraz *et al.* 2018). At BC, the assemblage was dated to 130–80 ka (Grün &

Beaumont 2001; Grün *et al.* 2003; de la Peña *et al.* 2019). Val *et al.* (2021) used equid teeth to date the Pietersburg of OBP to a much earlier date of 150 ± 14 ka. As with the MSA I, the Pietersburg has wide ranging and differing dates, however its technology is better understood.

The Pietersburg's raw material procurement has followed similar trends to the MIS 5 and has usually prioritised the use of locally available material (Porraz *et al.* 2018). In Bed 5 at the Cave of Hearths, quartzite is the most prominent (Mason 1962; McNabb & Sinclair 2009; Oberholzer 2021) although several other materials have been identified in various assemblages. Unidirectional reduction (Oberholzer 2021) and discoidal cores (McNabb & Sinclair 2009) dominate the assemblage at CoH. Formal tools found in Bed 5 at CoH include backed pieces, borers, notched and denticulated pieces, and scrapers and make up 6,3% of the assemblage (McNabb & Sinclair 2009; Oberholzer 2021). At BRS, a similar percentage of formal tools (5,2%) have been identified in the form of notched and denticulated pieces, and end- and sidescrapers (Porraz *et al.* 2018).

The M3 phase at Blombos Cave (BBC) exhibits similar attributes to technology at KRM. The assemblage is dominated by the local procurement of silcrete, quartz, and quartzite. The technology has been described as unidirectional and centripetal parallel reduction strategies alongside the presence of inclined cores. In terms of tools, the assemblage presents similar to other coastal assemblages where a small portion is identified as tools (1,3%) that are made up of notched and denticulated pieces, scrapers, burins, and borers (Douze *et al.* 2015).

Ysterfontein 1 stands out somewhat in the MIS 5 of the Cape sites and is dated to between114-140 ka (Schmid *et al.* 2016) and, more recently, 113-120 ka (Niespolo *et al.* 2021; Tribolo *et al.* 2022). Unlike most of the sites discussed here, the dominant raw materials used to manufacture lithics are calcrete and silcrete, although these materials are locally available. The assemblage has been described as a flake industry with a small component of blades and the primary percussion technique is inferred as hard hammer percussion (Wurz 2012). However, the assemblage stands out with regard to tools. Retouch is relatively high, particularly in relation to other MIS 5 assemblages in southern Africa, with 19% of the assemblage being described as tools (notched and denticulated pieces, and scrapers) (Wurz 2012; Schmid *et al.* 2016).

2.5 Complex behaviour

The MSA does not line up entirely with the emergence of *Homo sapiens* (also known as Anatomically Modern Humans) (Wadley 2015). This period is characterised by increased technological diversity compared to the ESA and the appearance of increasingly complex human behaviour. That is not to say that anatomical modernity is linked to some form of ‘behavioural modernity’. The purpose of this sub-section is to illustrate what behaviours could be expected of humans by the time of the SBLS occupation based on current inferences made on MSA behaviour.

The remains of *Homo sapiens* have also been recovered from KRM. These remains have come from several excavations and multiple layers and there is seemingly a large cranial bias as much of the material has been identified as cranial segments. The material has contributed to the debate over MSA human evolution; however, it does suffer from a lack of spatial, stratigraphic and geochronological contextualisation. Although, specimens have pointed towards both more archaic *Homo* morphological traits as well as some that are “manifestly modern” (Grine *et al.* 2017: 54) in morphology. Whether these specimens are derived from a single population or several lineages is unclear, however there is a potential pattern emerging which points towards general but incomplete morphological modernity amongst KRM’s *Homo sapiens* (Grine *et al.* 2017).

There has been much debate over whether complex cognition is a characteristic of the MSA or LSA, however human cognitive evolution has been a long, continuous and incremental process where evidence of complex cognition can be traced back to over 100 ka (Lombard & Högberg 2021; Wadley 2021). *Homo* has had the mental ‘hardware’ for this complexity since the advent of its genus (Zilhão 2007; Wadley 2013). Studies into the mental architecture of past hominins show that *Homo sapiens* had a ‘modern’ 9-subsystem mental architecture, which means the sequential memory and reasoning required for executive functions are argued to have been present by 100 ka (Coolidge & Wynn 2016). Lombard & Högberg (2021) put forward a four-field co-evolutionary model that argues for four major characteristics that make humans ‘sapient’ and thus sets us apart from other living animals. These are cognitive, biological, social, and ecological characteristics (see Lombard & Högberg 2021). Of interest is the conception of the 7-grade causal cognition model. These grades (from 1 – 7) are: Individual causal cognition, Cued dyadic-causal cognition, Conspecific theory of mind, Detached dyadic-causal cognition, Non-conspecific theory of mind, Inanimate causal cognition, and Causal network cognition (see Lombard & Gärdenfors 2017; Lombard & Högberg 2021 for extended explanations). These seven grades will be brief described here. Grade 1, individual causal cognition, relates to the immediate ability for an individual to link their physical motor action to the result of that action. Cued dyadic-causal cognition, grade 2, refers to two or more individuals' abilities to understand that by imitating each other's actions they can infer that they may attain the same result from the same action. Grade 3, conspecific theory of mind, refers to a species' Theory of Mind which dictates the ability of individuals to understand the causes and effects of their actions in the past, present and future as well as infer things such as the intentions, feelings, and actions of others through social learning. This Theory of Mind is well developed in humans, for example. Detached dyadic-causal cognition, grade 4, is the ability for an individual to perceive another individual or their presence through time and space, meaning that they can formulate two separate mental representations simultaneously. An example of this would be an individual being able to perceive footprints as well as understanding that these footprints represent an individual in the past who walked through the area. Grade 5, non-conspecific theory of mind, refers to an individual's ability to perceive the actions or intentions of another species that shares the landscape with them. Inanimate causal cognition, grade 6, refers to the ability to assign roles to inanimate objects in the surrounding environment. Examples of this would be the ability to assign a causal role to a sharp stone flake as it could be used for cutting, or that twine wrapped around a projectile shaft allows for hafting of stone points. Finally, causal network cognition (grade 7) refers to the ability to link and integrate the other grades together and bring together several levels of causal thinking to allow for more complex concepts such as hypothetical thinking and learning through reasoning by being able to rearrange differing concepts gained from the different versions of causal thinking (adapted from Lombard & Gärdenfors 2017; Lombard & Högberg 2021).

All seven grades are believed to have appeared as behavioural signatures in past hominins by the late MSA. At least the first six of the seven of these grades were attained by humans by the SBLS period, with the seventh being inferred from the use of bow and arrow technology which appears after this. Therefore, this demonstrates that the capacity for complex cognition existed in the MSA (Wadley 2013).

This so-called 'complex cognition' entails the necessary competency to carry out more complex behaviours in the MSA (Wadley 2015). These complex behaviours are viewed as more complex subsistence strategies than earlier hominins which we see through technological innovations (Wadley 2013, 2021; Blackwood & Wilkins 2022) like the use of bone tools alongside stone, as well as the development of ‘symbolic thought and the use of resources such as ochre’ (Wadley 2015; Wurz 2018).

The development of executive functions (Coolidge & Wynn 2016) can be linked to the increase of material culture in the form of transformative innovations that formed part of everyday tools (Wadley 2013). Transformative innovation refers to raw materials that have been irreversibly altered during their production sequence. Wadley (2013) argues that transformative innovation is represented by the use of compound adhesives in the hafting process as well as the heat treatment of lithic tools. They suggest that these two factors represent complex cognition, as a certain level of planning, resource inhibition, and multitasking is required to manufacture this material. Although this irreversible transformation could be applied to knapping of lithics themselves, as these stone tools cannot return to their original raw state once they have been knapped, this is not regarded as specific to *Homo sapiens.* Therefore, based on inferred decision making through cognigrams (Haidle 2010) and hierarchical diagrams (Muller *et al.* 2017), the intricacy of *Levallois* lithic material also illustrates a high level of planning and abstract thought. Therefore, MSA *Homo sapiens* evidently had the ability for some level of complex cognition that could then be extended to their behaviour, allowing for significant complexity in subsistence decisions (i.e., hunting or the exploitation of marine resources).

Complex behaviour has also been recognised in several other aspects of the MSA. In their discussion of complex behaviours, Clark *et al.* (2022) set out the concept of the domestic space in which humans in the past would have carried out several social tasks regarding subsistence behaviours, for example, processing and cooking food, sleeping, and performing other activities such as tool manufacturing. Following this four-interval model of increasingly complex human behaviour (Clark *et al.* 2022), the SBLS humans would have had a complex use of fire, undertaken intense and repeated occupations of the site, may have manufactured bedding and established sleeping areas (as seen at Border Cave prior to the SBLS, see Backwell *et al.* (2018) and Wadley *et al.* (2020)), and repeatedly used the same spaces for hearth building.

The remains of starchy plants have been studied from intact hearths from two periods of the MSA at KRM: 120 kya (MIS 5e) and 65 kya (or MIS 4). The plant remains formed part of charred remains present in hearths. The conclusion drawn from this was that over a substantial period of the MSA on the southern cape, humans not only consumed starchy food but also cooked this resource (Larbey *et al.* 2019) which was likely processed alongside both terrestrial faunal resources and marine resources (Blackwood & Wilkins 2022; Brenner *et al.* 2022) collected from the coast as the evidence for terrestrial and marine resource exploitation is widespread.

The hunting of terrestrial prey also provides insight into the complex behaviours of humans more than 100 000 years ago. The proliferation and diversification of stone points throughout time and space in the MSA has been seen as widespread evidence for complex hunting (Mcbrearty & Brooks 2000; Blackwood & Wilkins 2022). The innovation of compound technology (Wadley 2013), in this case the hafting of stone points on shafts, allowed for the creation of a varied range of hand-delivered and mechanically projected hunting implements. These implements are evidence of varied and complex hunting behaviours where humans could attain ecological advantages by broadening their niche, reducing risks when hunting dangerous terrestrial prey types, and improving their hunting return rate (Blackwood & Wilkins 2022). Again, this indicates a substantial ability to undertake complex subsistence behaviours. Therefore, it is clear that SBLS human would have had the ability to undertake complex behaviours.

2.6 KRM Palaeoenvironment at MIS 5d

Marine Isotope Stages (MIS) have been frequently cited as temporal markers in MSA literature (Wadley 2015) and regularly come up in research specific to the paleoenvironment (cf. Dor 2017; Cawthra *et al.* 2018; Reynard & Wurz 2020; Reynard 2022; Wurz *et al.* 2022). The SBLS has been dated to before 110 ka (Wurz *et al.* 2022) which would place the layer in at least the MIS 5d-e; which starts at 115ka (following Wadley 2015). During the MIS 5d-a (~115 and 80 ka) (Cawthra *et al.* 2018), sea levels fluctuated significantly with higher levels during MIS 5c compared to MIS 5d and b (Dor 2017; Cawthra *et al.* 2018). The sea level is understood to have generally oscillated between 36 and 29 metres below the mean sea level at around 110 ka along the southern Cape coast based on readings from the Great Brak River, Western Cape. While secondary readings that are dated to MIS 5d report sea-levels of 34 and 36 metres below mean sea-level (Cawthra *et al.* 2018). Sea-levels have also been modelled to have been as low as 44,72 metres below the mean sea-level during the MIS 5d (Dor 2017). This indicates that the geography of KRM during this period would have been significantly different to the contemporary site as the Palaeo-Agulhas Plain would have been largely exposed. Based on the inferred sea levels of Cawthra *et al.* (2018), KRM would have been roughly 3.20 kilometres from the water's edge which has led to the assumption that access to marine resources was unhindered. This is supported by KRM falling within the 5-6 km typical travelling distance for shellfish exploitation, put forward by Marean (2010), and the significant shellfish material recovered from the SBLS layer; discussed by Brenner *et al.* (2022).

Braun *et al.* (2020) argue that although moisture levels fluctuated, there was sufficient precipitation and moisture availability throughout the MIS 5 period in the Cape coastal lowlands and Palaeo-Agulhas Plain. Therefore, this region, which includes KRM, would have contained a variety of vegetation types (Braun *et al.* 2020) which includes, thicket, grasses and the Greater Cape Floristic Region plant types (van Wijk *et al.* 2017). Following the lithostratigraphic context employed at KRM, the MSA I is believed to coincide with MIS 5e temporally (Reynard & Wurz 2020; Wurz *et al.* 2022). Faunal data provide some indications on the environment. The faunal data related to the MSA I indicates that grazers are common when compared with later layers which suggests that the environment at the time was more open and grassier (Reynard & Wurz 2020; Reynard 2022). However, the micromammal evidence suggests the presence of both drier as well as closed environments based on the identified species. This seems to point towards a mosaic environment surrounding KRM (Nel *et al.* 2018). Finally, Faul (2021) discusses ostracod data from the overlying BOS Three layer which also falls within the MIS 5d period at KRM. The environment seems to have evidence of brackish water which indicates the presence of an estuarine in the vicinity of the KRM caves (Faul 2021).

2.7 Coastal Adaptation

Coastal Adaptation is viewed as the relevant behaviours linked to the exploitation of shoreline and marine resources (Marean *et al.* 2007). To expand on this, coastal adaptation definitions also frequently state that this adaptation is a characteristic of populations that systematically exploit marine and coastal food sources which form the majority of their diet (Fitzhugh 1975; Yesner 1980; Erlandson & Fitzpatrick 2006; Will *et al.* 2019). The populations that are argued to exhibit such behaviours, or at least leave traces of these behaviours, have long been considered to be a specialised sub-set of hunter gatherers (Yesner 1980). Although it is likely that earlier hominins may have been able to exploit some forms of coastal or marine resources, the earliest existing evidence for sophisticated technology and more systematic exploitation appears within the African MSA and the advent of *Homo sapiens* (Erlandson & Fitzpatrick 2006).

The southern Cape coast and its respective MSA archaeological sites provide much of the data on the coastal adaptation of *Homo sapiens* in Africa (Will *et al.* 2019). As one of these southern

Cape sites, KRM is situated at the eastern most edge of the Greater Cape Floristic Region (GCFR) and the Palaeo-Agulhas Plain. Therefore, the site, both now and from MIS 6 onwards, has never been more than ten kilometres from the shoreline (Reynard and Wurz 2020), and, like most coastal sites, contains evidence of marine resource exploitation (Will *et al.* 2019).

Coastal adaptation is a behavioural strategy that entails the more or less continued and systematic exploitation of coastal resources such as molluscs, fish, sea mammals and sea birds as a food resource. Occasional exploitation of marine resources in the form of shellfish consumption is present at Pinnacle Point 13B dating to around 160 ka (during MIS 6) (Will *et al.* 2019). This points to these behavioural traits already forming part of human behaviour; however, it seems that continued and systematic exploitation of marine resources only began following the Eemian interglacial period. Therefore, coastal adaptation is argued to have become prevalent during MIS 5-3, roughly 110 to 50 ka (Will *et al.* 2019; see Wadley (2015) regarding Marine Isotope Stages boundaries). This argument may be supported by the shellfish remains recovered from the recently excavated layers (SMONE, BOS 1-3 and SBLS) which all contain shellfish material and seemingly point towards increased exploitation, based on a greater sample, in earlier layers (i.e., SMONE and BOS) (Brenner *et al.* 2022).

Van Niekerk (2011) specifically discusses the exploitation of fish within the MSA of the southern Cape. At KRM, exploitation is present in both the MSA I and II. Therefore, it seems clear that coastal adaptation did extend to the catching or trapping of fish. However, it is unknown what method was used to accumulate fish during this period.

2.8 Methodological background and theory

2.8.1 The *Chaîne Opératoire*

The *Chaîne Opératoire* does not stand alone as the only theoretical and methodological approach to understanding lithics of the past and the possible past behaviours we may be able to infer from their study. For example, two other approaches are Christopher Carr's Unified Middle-Range Theory of Artefact Design and Behavioural Archaeology and Behavioural Chain Analysis (see Tostevin 2012). The *Chaîne Opératoire* method has been undertaken in this study as the study of the operational chain on lithic manufacture has previously been widely employed within southern African Stone Age archaeology, particularly in the MSA of the southern Cape and at KRM (see Wurz 2000; Oberholzer 2021). The study of the *Chaîne Opératoire* relies on the analysis of attributes present on the lithic material that provide the possibility of making inferences on the steps required to manufacture the specific tools. These attributes are technological and morphometric in nature.

The *Chaîne Opératoire* was born out of the approaches employed by the French *Technologie* school and has its roots in the ethnological works of Marcel Mauss that championed understanding society through the techniques they employed (Mauss 1936; Soressi & Geneste 2011; Tostevin 2012). Technique in this instance referred to human behaviour which was how humans in a society action their bodies in manners that are viewed as 'effective and traditional'. Mauss describes this with the example of swimming, that is, that different societies (and by extension different generations within a society) would undertake the action of swimming in different ways. The manner of undertaking the action is both effective, meaning that the technique for swimming for the different societies allows them to swim, and traditional which means that the technique is replicated by the members of a society so it is culturally significant (Mauss 1936: 5–6). Following this, the prehistorian and ethnologist André Leroi-Gourhan brought material culture under the concept of *Les techniques du corps* (Mauss 1936) through the concept of *le geste*, or gesture, which refers to the action of the body (in the same manner as Mauss) upon a tool or to use a tool (Leroi-Gourhan 1943, 1945; Audouze 2002; Tostevin 2012). The term "*chaîne opératoire*" was first put into practice by Leroi-Gourhan (1964: 164) but the term was not formalised at this point (Schlanger 2004; Soressi & Geneste 2011). However, the theoretical and methodological foundations of the *Technologie* school had been laid. Following this, several researchers applied this technique to their research on lithic artefacts specifically (see Tixier *et al.* 1980; Haudricourt 1988; Pétrequin & Pétrequin 1994; Tixier 2012).

Thus, the study of the *Chaîne Opératoire* has been used over the last number of decades. The approach has focused on studying the manufacturing process of lithic material to better understand the techniques used by the manufacturers of lithics and how this drove social production and reproduction (Soressi & Geneste 2011) in the same manner that human actions or behaviours are seen as an established aspect of culture in society for ethnologists (Tostevin 2012). This is based on the understanding that lithics, as with all other cultural material, are culturally sensitive where raw material undergoes a cultural transformation to become culturally specific (Sellet 1993). Therefore, the approach is a study of techniques of tool manufacture from which social behaviour or decisions can be inferred (Soressi & Geneste 2011). To understand the social behaviour and decision making in the past, the concept of intentionality becomes important and remains relevant in contemporary research. Intentionality means that humans in the past made purposeful decisions which were informed by every evolving motor skills and cognitive development and not through happenchance (Audouze 2002). The *Chaîne Opératoire,* or the study thereof, is effectively an analytical tool making insights on technology based on regularities and physical attributes. There are several steps to understanding past decisions and techniques, and these are: raw material procurement, method of reduction, technique of flake removal, and retouch, use and discard.

The *Chaîne Opératoire* is, however, not without some short falls, although some of these are believed to affect all lithic analysis approaches (Soressi & Geneste 2011), while the *Chaîne Opératoire* or at least its original conception by Leroi-Gourhan suffers from an unresolved problem (Audouze 2002). While Leroi-Gourhan put forward the tool development was linked to the genetic development and evolutions of humans, it is unclear how in later period this genetic development of tools shifted to development that was driven by social factors (Audouze 2002). Turning to the limitations within lithics research, three limitations have been identified and these are the problems of co-occurrence, representation, and completeness. Firstly, co-occurrence refers to a problem experienced by all lithic analysis approaches and this problem is that deposits and lithic assemblages from specific layers at a site may represent a single or successive occupations over a longer time period. Therefore, it is difficult (if not impossible) to tell whether differing co-occurring methods or techniques in the production of lithics occurred simultaneously or followed one another in successive occupations within the same layer (Soressi & Geneste 2011).

Secondly, problems with representation can become apparent as the methodology requires that an attribute that indicates a particular technique must either be represented by numerous artefacts in an assemblage or a small number of artefacts in the assemblage must possess diagnostic markers that could link them to a technical pattern that has previously been recognised by a greater number of artefacts. Therefore, it is difficult to discern whether an attribute present on a small number of artefacts in an assemblage represents a wider technique, thus some techniques in the past may be obscured (Soressi & Geneste 2011).

Thirdly, the problem of completeness relates to the size of the samples analysed. Some techniques that are observed may not be adequately accounted for as the number of pieces representing the technique is small. To rectify this problem a bigger sample would be needed, however, to limit the impact of the problem of co-occurrence (described above) the smallest time-depth of an assemblage is required which then limits the possible size of an assemblage sample. Therefore there is a continual trade-off between limiting time-depth and ensuring that the assemblage sample is all-encompassing (Soressi & Geneste 2011).

Finally, the use of *chaîne opératoire* in both ethnographic and prehistoric contexts has raised a debate over the etic and emic understanding of choice making by the manufacturers of cultural material. The somewhat restricted emic view of decision making, that is to say that an artisan's choices are only informative if the artisan is aware of more than one technique and is intentionally choosing one, is epistemologically valid in ethnographic work where an artisan can be questioned on their perception of possible choices. However, in prehistory the artisan cannot be questioned which means the perception of choices lies in the hands of the researcher. This has become an issue that splits researchers based on their conception of society and social change (Tostevin 2012). Wiessner (1983) has also shown through their ethnographic work with San artisans that style and techniques can be unconscious, unintentional, and etic in nature. Therefore, techniques in the past may not be diagnostic indictors of cultural identity as the *chaîne opératoire* cannot function in such a manner as to create cultural typologies.

This does not mean that the *chaîne opératoire* cannot be used as an effective tool to study the past. The issue within the etic and emic argument of social conception is more a problem regarding what questions a researcher wishes to answer about the past through material culture rather than a problem relating to the methodological or theoretical foundations of the *chaîne opératoire* (Tostevin 2012). Palaeolithic/Stone Age archaeology will be able to pursue a ground-up approach to social formation through technique as Leroi-Gourhan (1964) had intended. Researchers are able to study long term social changes in prehistory as differences between style and function can be avoided as society can be viewed as the continued social representation created and recreated through the acts of manufacturers in the past, and not simply as rules and boundaries that govern identity and ethnicity (Gamble 1999; Tostevin 2012).

2.8.2 Tip cross-sectional area analysis (TCSA) and SBLS

Tip cross-sectional area (TCSA) analysis forms part of a methodological approach which focuses on the study of weapon engineering (Hughes 1998). This weapon engineering relates to the specific morphology and weight of lithic points and how that affects their use as implements particularly in terms of their effectiveness in penetrating the skin of a target. Different variables have been tested in an attempt to assess the likely trade-offs and compromises that may affect how points are selected for a specific weapon and its use. The variables that were originally identified through the study of weapon engineering are mass of the point, cross-sectional area, the shape, and durability of the material the point is made from. Understanding weapon engineering has become an important avenue to understanding human development and behaviour as through the lens of the evolutionary paradigm, weapons and weapon systems are believed to be part of the wider human ‘phenotype’ and, therefore, also subject to change and continued evolution (see Hughes 1998 for an expanded debate on this). In early studies that took other variables into account alongside the tip cross-sectional area variable, several categories of ‘primitive’ weapons systems were created (Hughes 1998), which have also been established to have been used in the past through ethnographic evidence (Shott 1997). Following this, Shea (2006) focused on the tip cross-sectional area variable to assess prehistoric weapon delivery systems and established three types of delivery systems which could be used to assess the size of lithic points. These were arrowhead, dart (spearthrower-and-dart weapons), and handheld thrusting spears. These categories were used widely in several studies of prehistoric lithic implements (Villa & Lenoir 2006; Pargeter 2007; Villa & Soriano 2010; Wilkins & Chazan 2012; Groucutt 2014; Duches *et al.* 2019; Dietrich *et al.* 2020; Yaroshevich *et al.* 2021).

Originally, the three-category system underwent no adjustments (Newman & Moore 2013; Clarkson 2016; Lombard *et al.* 2022b). However, within the southern Africa research context, it became apparent that the three-category system was insufficient for assessing weapon delivery systems based on the large corpus of ethno-historical evidence on hunting weapons and lithic point masses collected in the region, which seems to indicate greater variability in weapon delivery systems and the possible use of more than one system at any one time (Lombard 2021a, 2022). This morphometric analysis provided a hypothesis on the possible weapon uses of lithic points based on their size.

Lombard (2021a) undertook a TCSA study of point assemblages from several MSA sites within southern Africa using these expanded categories that included poisoned arrowheads and javelins. In general, the portion of the results from this study that covers the MIS 5 provided data from twenty sites in southern Africa. The bulk of the older MIS 5 sites provided TCSA values that point towards a dominance of points that could fall within the javelin or thrusting spear categories. Later MIS 5 strata (±70 ka) at sites such as Umhlatuzana, Diepkloof, and Apollo 11 seem to possess assemblages that have lithics in the dart tip category alongside the larger javelin and thrusting spear categories (Lombard 2021a). The SBLS sample that was analysed was small (n=48), however it has provided preliminary inferences into the possible use of the points in this layer. The layer stands out as an anomaly in the study as the analysis seems to indicate a size range that is dominated by points most suited for tipping light-weight javelins (45.8%), arrows (39,6%) and spearthrower-and-darts (33,3%) which is significantly different from the other MIS 5 assemblages. These values are significantly higher in comparison to any of the roughly contemporaneous assemblages from other MSA sites in southern Africa. Although TCSA analysis is viewed as a useful morphometric approach used in lithic analysis as it provides broad comparative datasets, it does not infer the 'true' function of the lithic material, but rather categorises possible effective uses for the points based on size profiles from which hypotheses can be formed (Lombard & Shea 2021).

Lombard and Shea (2021) discuss the use of spearthrower-and-dart technology in Africa by MSA *Homo sapiens* and TCSA implications. At this point little evidence exists to support the use of darts by Pleistocene hominins in Africa and inferences remain speculative as seen with Howiesons Poort material from Pinnacle Point (cf. Lombard & Shea 2021). Added to this, javelins have been accepted as possible MSA hunting implements, however if morphometric analysis is undertaken alone javelin and dart tip hunting is indistinguishable. Finally, the evidence for bow and arrow usage also post-dates the SBLS by several thousand years. It is at this point that this analysis began as the expanded lithic points sample of the SBLS provided clarity on this anomalous period in the usage of lithic points and inferred behaviours of the past.

2.8.3 Macro-fracture analysis

Macro-fracture analysis involves the analysis of fractures present on lithic material that can be studied using the naked eye or a hand lens (Pargeter 2011). The macro-fractures that are key to this analysis are assumed to have been caused by the 'head-on' impact of lithics during hunting (Pargeter 2013). The morphology of macro-fractures has been interpreted through several experimental studies over the last number of decades (Fischer *et al.* 1984; Odell & Cowan 1986; Lombard *et al.* 2004; Lombard & Pargeter 2008). 'Diagnostic impact fractures' (DIF) or impact fractures have been used to describe the particular fractures which are associated with lithic artefacts that are inferred to be hunting equipment (Lombard & Pargeter 2008; Pargeter 2013). These DIFs have been placed into several categories based on the morphology, with the major groups being: cone, bending, and spin-off fractures (Fischer *et al.* 1984), and impact burinations (Lombard 2005a). Rots and Plisson (2014) raise several issues over the variables that affect macro-fracture studies as well as the problems associated with only relying on macro-fractures alone to infer use. Similarly, Pargeter (2011; 2013) undertook experimental studies to assess the rock type and trampling/knapping variables. Pargeter (2011) concluded that trampling by both humans and fauna and accidental knapping fractures can create similar fractures to the impact fractures that have been regarded as evidence for usage, however these accidental fractures seem to occur in low frequencies (<3%). Pargeter (2013) assessed rock type and concluded that the type of rock is not a key variable in fracture formation as all rock type displayed similar fracture frequencies. It would seem that to avert some of the problems set out by the authors above, macro-fracture analysis must remain an initial step in usage studies that must be coupled with other morphometric or use-wear studies (Pargeter 2011) and that impact fracture patterning on lithics may play a more important role, as a simple impact fracture and its simple identification cannot be used to infer usage (Pargeter 2013).

2.9 Conclusion

This chapter has covered the background and necessary overview to understanding the MSA of the southern Cape and the relevant lithic industries of the region that broadly coincides in time period and technology with the SBLS layer at KRM. This background allowed for a more thorough comparison of the technological and behavioural trends between the SBLS and both other KRM and regional assemblages.

Finally, the latter part of this chapter set out the theoretical and methodological foundations of the research methodologies that were undertaken in this study. The methodology employed here has been published extensively and is underpinned by theory which has been widely employed over many decades. Understanding how and why the *chaîne opératoire* and TCSA analysis is employed in lithic studies is paramount to understanding how conclusions can be drawn from the attributes of the physical material and how that represents behaviour in the past, which allows for the hypothesis to be tested effectively.

CHAPTER 3. STUDY MATERIAL AND METHODOLOGY

3.1. Introduction

This chapter serves to outline how the *Chaîne Opératoire* approach, as well as TCSA and macro fracture analysis, was undertaken to assess the SBLS lithic sample in an attempt to test the research hypothesis through the aims and objectives. The relevant analytical methods are outlined following the structure of the *Chaîne Opératoire,* where TCSA and macro fracture analysis fall under the retouch, utilisation, and discard step. The study material, or sample, originates from the recently excavated SBLS layer of the Witness Baulk at KRM in 2020. A small sample of the SBLS lithics excavated during 2018 have been previously discussed by Brenner *et al.* (2022) and Lombard (2021a) where preliminary conclusions could be drawn on the nature of the lithic technology and usage. The small sample analysed by Brenner *et al.* (2022) consisted of 199 pieces >20mm and 2276 pieces of small debitage <20mm, while the points sample analysed by Lombard (2021a) consisted of 48 lithic points. Here, a much larger, possibly more complete sample, has undergone analysis which will test these conclusions as they have informed the research hypothesis in this study. The sample analysed in this study does not include any of the material that has already been analysed and published. Finally, Appendix A sets out a table of all the analysed attributes and their categories or parameters on how they were analysed.

3.2. Sample

The material for this study was obtained from the SBLS deposits excavated in 2020. This material originates from the nine metres^2 that encompasses all squares (A1 to C3, Figure 3.1.) of the recent Witness Baulk excavations. The study provides the full assemblage composition in relation to blanks (categorised as blades, bladelets, points, flakes, and indeterminate), cores, fragments, chunks, chips, shaping flakes, and hammerstones (cf. Brenner & Wurz 2019). The production of *debitage*, that is, intentionally fracturing the raw material to create lithic blanks, is classified and separated into two categories: cores and *debitage* products. *Debitage* products are discussed generally as lithic flakes or blanks in this study.

In this case "lithic flakes" refers to flakes in the broadest sense as a piece of rock detached from a core. Similarly, the use of "blank" follows Andrefsky (2008) where a blank is a detached piece of rock which is then potentially modifiable. Therefore, blanks and flakes (in this instance blank and flake were used interchangeably at times). In the case where flake is used as a basic ‘blank’ category alongside categories such as blade or point, its usage in this context will be apparent. Finally, the term ‘end-product’ is also used to discuss lithics which could be classed specifically as tools and in some cases showed evidence of usage.

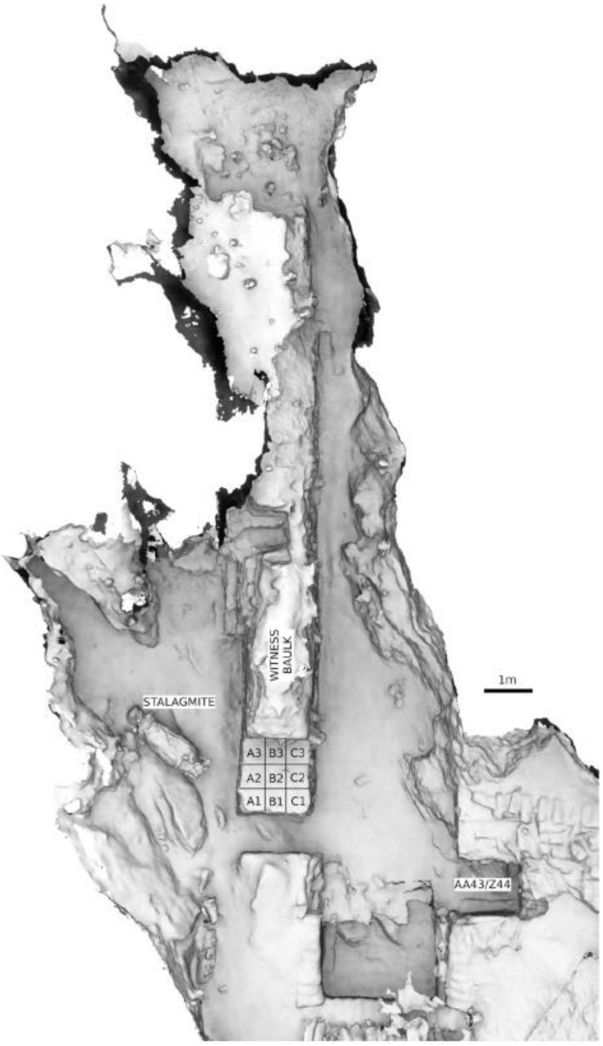


Figure 3.1 KRM Cave 1 with the Witness Baulk in the centre, including the excavation grid with squares A1 - C3 (image courtesy of the Zamani project, taken from Brenner and Wurz (2019)

The core refers to a raw material that possesses evidence of negative flake scars, striking platforms, platform preparation, and (possibly) evidence of earlier and later removals which indicates a chronological process of removals (Inizan *et al.* 1999). Core fragments also have to be taken into account. However, they may not possess clear signs of a chronological process of removals. Therefore, it is important to assess all the attributes in conjunction with one another. Flake fragments and chunks refer to fragmentary *debitage* that do not fall into any of the blank categories listed above. Flake fragments are lithics with clear dorsal scars that are >20mm in size, however these lithics have at least 3 fractures on their margins. The classification of chunks is not dependent on the size of the lithic and have been recorded in both the >20mm and the <20mm sub-samples of the assemblage composition. The key attribute of a chunk is that it is angular debris with no clear flake scars and is generally classed as knapping debris (Villa *et al.* 2005; Soriano *et al.* 2007; Henshilwood *et al.* 2014; Douze *et al.* 2018). The final categories make up the <20 mm sub-sample. Chips differ from shaping flakes as they are fragmentary *debitage* smaller than 10mm with no recognisable flake scars whereas shaping flakes are small (<10mm) complete flakes (Wurz 2000) that are argued to have possibly originated from the shaping and maintenance of platforms, among other behaviours. Chips are separated from chunks based on this size classification. Hammerstones refer to the natural (stone, wood, or antler, for example) implement used as the percussor in the knapping process. These percussors have been separated into soft and hard hammers, where the soft hammers are largely biological in nature (bone or wood, for example) while hard hammers are made from stone. The key attributes to a hammerstone will be evidence of pitting (Douze *et al.* 2015) and hammerstones may become rounded from use (Inizan *et al.* 1999).

The amount of excavated deposit is provided in litres and its volume (m^3) has been calculated. The density of lithics per litre of excavated deposit as well as lithic weight per square is provided. Density is calculated following Wadley *et al.* (2016), Oberholzer (2021), and Brenner *et al.* (2022). This entails dividing the total number of lithics by the litres of excavated sediment for each square A1 – C3.

3.3 Lithic analysis

This study employed a technological, morphometric, and macro-fracture analysis approach to analyse the SBLS material, which was then used to infer the production and utilisation (specifically, hunting) behaviours of *Homo sapiens* >110ka at KRM.

The morphometric analysis records a wide range of morphological attributes of the lithics such as material type (Cairncross 2004; Norman & Whitfield 2006), technology (Villa *et al.* 2005; Soriano *et al.* 2007; Wilkins *et al.* 2017), platform characteristics (Inizan *et al.* 1999; Wilkins *et al.* 2017), retouch (Inizan *et al.* 1999), and tool category (Douze *et al.* 2015). The dimensions in millimetres (mm) and weights in grams (g) of all lithics were recorded using a digital calliper and an electronic scale. These attributes were selected in an attempt to create the most thorough data set possible to allow for the broadest possible analysis of the material following the *Chaîne Opératoire.* These attributes have been widely used in several studies throughout southern African MSA research and abroad (see for examples, Tixier *et al.* 1980; Inizan *et al.* 1999;

Roussel *et al.* 2009; Wurz 2012; Douze *et al.* 2015, 2018; Brenner & Wurz 2019; Oberholzer 2021; Bader *et al.* 2022b). The use of these attributes allowed for extensive comparison both with material at KRM and with broader regions in southern Africa.

In keeping with the investigation of taphonomic processes at KRM on fauna (e.g., Reynard 2022), post-depositional attributes such as fragmentation and encrustation on the lithics were recorded as well (discussed at the end of the chapter). Following this analysis, inferences into the *Chaîne Opératoire* (or production sequence) were made following the work of Inizan *et al.* 1999; Sellet (1993) and Soressi and Geneste (2011).

3.3.1 Raw material

The first step of the *Chaîne Opératoire* is the collection of the raw materials which would undergo reduction into lithics. This first step displays the first practical decision taken by hominins in the course and scope of manufacturing lithic implements. The procurement of raw materials can be established by classifying the material that the lithics are made from. This can also provide inferences into material harvesting decisions based on the relative spatial availability of a particular rock type at a site. Raw material identification was done by visually inspecting the material with the naked eye, in the same manner as Brenner and Wurz (2019) and Oberholzer (2021), to determine what it is. Cairncross (2004) and Norman and Whitfield (2006) were used as reference literature against which interpretations can be assessed. Both provide overviews of the geology and rock types that are readily available in South Africa, including the KRM environment in the southern Cape. KRM falls within areas ascribed to the Cape supergroup (Brenner & Wurz 2019) and the Algoa group (Council for Geoscience n.d.). Based on previous work, quartzite is the raw material that has been most frequently utilised at KRM (Singer & Wymer 1982; Wurz 2000, 2002), and this is similarly seen in the 2018 SBLS sample (Brenner *et al.* 2022). However, quartzite varies in crystal size, meaning separating fine to medium grained quartzite from coarse grained quartzite can be significantly more subjective. A sample specimen of both fine-medium grained and coarse-grained quartzite was used to ensure that consistency is maintained throughout the analysis (see Figure 3.2).

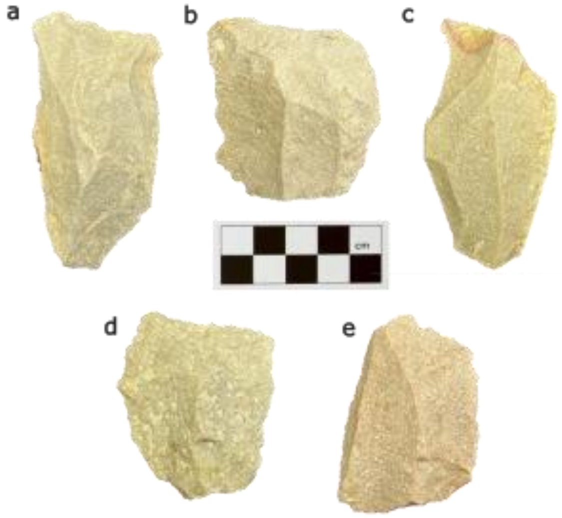


Figure 3.2. The sub-sample used to assess the difference between fine-grained and coarse-grained quartzites. Lithics a-c are fine to medium grained, while d and e represent coarse-grained material.

3.3.2 Technique of flake removal

The inference that researchers can draw on the technique of the flake removal relies on the assessment of physical attributes on flaked material (Andrefsky 2008). This is used to infer the manner in which they were removed from the core. The platform characteristics (length, thickness, angle, and preparation), the type of platform, and bulb of percussion were recorded. This was done to infer decisions that were made by the knapper in terms of the technique employed (Inizan *et al.* 1999; Andrefsky 2008) in the removal of the blank from the core. This indicates certain details regarding the hammerstone employed and technical decisions undertaken by the knapper to produce a blank.

The metric characteristics of platform length and thickness follow Wilkins *et al.* (2017). The platform length was measured as the total length of the platform from one lateral margin to the other. The thickness measurement was measured as the distance that the platform makes up between the dorsal and ventral surface margins (in the same manner as the general thickness measurement of a blank). This was measured using an electronic calliper. The platform angle measurement follows Dibble (1997) and Dibble and Rezek (2009) in measuring the external platform angle. This is the angle that lies between the striking platform plane and the plane of the dorsal surface. This was achieved by using a goniometer. The external platform angle (along with platform length and thickness) is under the direct control of the knapper and these metric attributes have some relationship to the size and morphology of flakes which indicates decision making in the past to at least some degree (Dibble 1997). In this study, the platform angle was separated into intervals of 10º (for example, 50º–59º, 60º–69º etc.). This was done to simplify the data and present it in such a way as to determine whether patterns exist based on the distribution of values between the intervals.

Platform preparation was assessed in three categories: no preparation, trimming, and rubbing. Trimming relates to the presence of the small removals, largely in the form of step flaking, at the platform on the ventral surface with the intention to thin the platform (Wurz 2000; 2002). Rubbing is the abrasion of the platform edge between the platform and dorsal surface which presents as a blunting of this edge and possibly the appearance of small hinged fractures (Soriano *et al.* 2007).

The type of platform denotes the morphology of the platform based on the facets/flake scars (or lack thereof) present that are created when the platform is prepared prior to striking (see Figure 3.3). The general categories follow Inizan *et al.* (1999) with slight adjustments following Brenner and Wurz (2019). These adjustments are the inclusion of 'unspecific' categories for facetted and dihedral platform types (for example, facetted unspecific and dihedral unspecific). This was done to accommodate platforms that could not be assessed as plain as some level of faceting exists, but in which the facets do not present clear faceting negatives as expected from the dihedral and facetted platforms (Brenner & Wurz 2019). 'Specific' faceting was referred to at points throughout the study to clarify its difference from unspecific faceting. This 'specific' faceting simply refers to platform four in Figure 3.3 as this faceting is specifically created to prepare the platform.

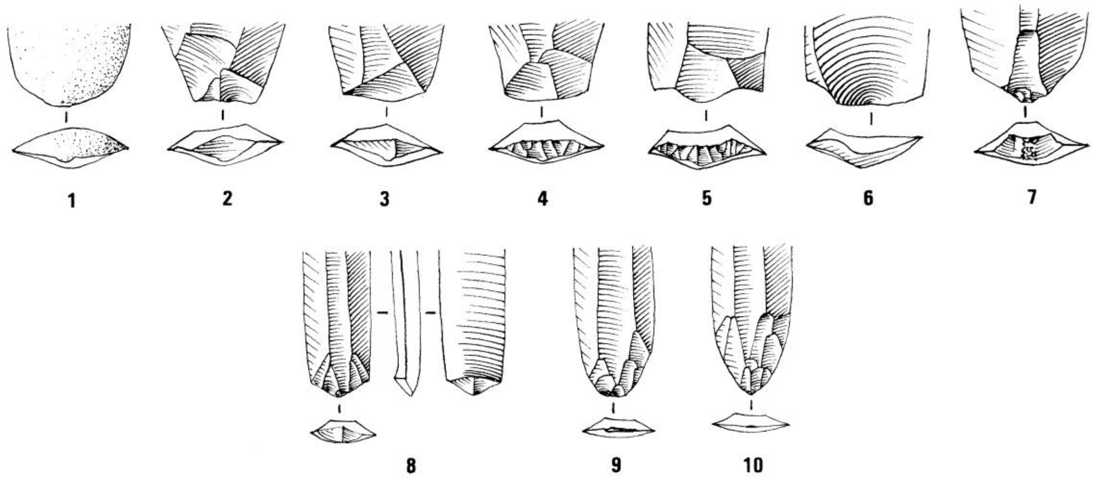


Figure 3.3 Types of Platforms: (1) cortical, (2) plain, (3) dihedral, (4) facetted, (5) "en chapeau de gendarme", (6) winged, (7) pecked, (8) spur ("en éperon"), (9) linear, (10) punctiform, following Inizan et al. (1999).

The bulb of percussion relates to the 'hump' that forms on the ventral surface of the flake below the striking platform. This is sometimes referred to as the 'bulb of force' as it forms when the blank is struck from the core due to the force being applied to the stone (Andrefsky 2008) and originates from the point of percussion on the striking platform (Inizan *et al.* 1999). Bulbs were only recorded on lithics that possess a proximal end, therefore excluding all other blanks (i.e., medial or distal pieces). Six categories were used to cover the wide range of bulbs that appear on lithic flakes. Firstly, a bulb may be entirely missing from the ventral surface and is thus classed as 'no bulb' (similarly identified by Soriano *et al.* (2007)). Secondly, broken bulbs are identified as bulbs that have cracked or broken off leaving a fracture which is connected to the impact point (Soriano *et al.* 2007). The three major categories of bulbs that can be identified and have been identified in several studies are prominent, diffused (weak), and negative bulbs (Wurz 2000, 2002; Brenner 2019; Oberholzer 2021). Negative bulbs (or *esquillement du bulbe*) relate to bulbs that possess a flake scar (Roussel *et al.* 2009) on the bulb due to the fracturing of a secondary or parasitical flake during the knapping process (Inizan *et al.* 1999). These scars have been differentiated from breaks as a negative bulb scar follows a similar morphology to a general flake scar that can range in size and depth (for examples on these negative scars see Figure 3.4 and Roussel *et al.* (2009). Both prominent and weak bulbs are conchoidal fractures which can be more or less pronounced (Inizan *et al.* 1999). The utility of using how pronounced a bulb of percussion is as a tool to assess the percussion in flake removals seems to be unclear as some authors argue for (Inizan *et al.* 1999; Wurz 2000) and against (Roussel *et al.* 2009) it.

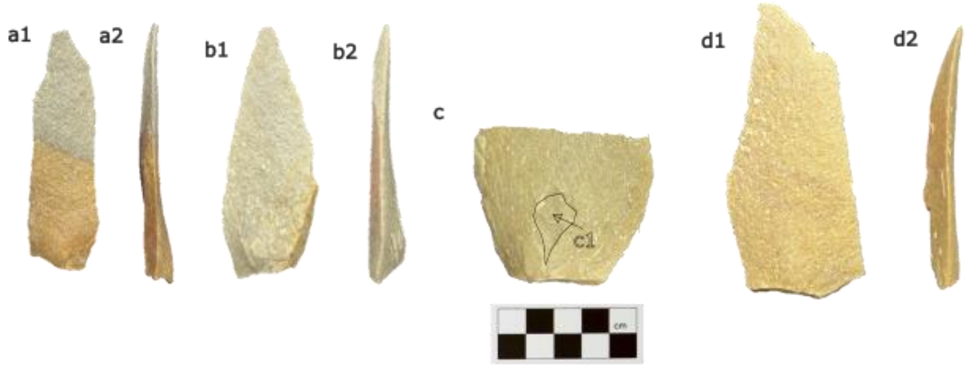


Figure 3.4. Representations of the relevant bulbs of percussion in this study. a1/2 & b1/2 represent 'prominent bulbs'. c represents a negative bulb where the flake scar is outline and labelled c1. d1 and d2 represent a diffused bulb. The negative bulb cannot be seen from the lateral view therefore it has been excluded.

The separation of prominent and weak/diffused bulbs into separate categories seems to be largely subjective. Therefore, a prominent bulb has been classed as a bulb which can be easily identified with the naked eye and the conchoidal shape is clearly visible making it ‘pronounced’. A weak or diffused bulb accounts for weakly developed bulbs that may just be visible, or in which the shape is best identified by rubbing the bulb area with a hand to assess the conchoidal shape. These visible bulbs can be noticeable with the naked eye but are less pronounced (Oberholzer 2021) and have been termed ‘medium’ bulbs in some studies (for example, Galili *et al.* 2018). Finally, an indeterminate category was used in instances where a fair categorisation could not be made, largely due to encrustation or other platform damage (unrelated to the bulb specifically).

Platform lipping, on the ventral margin of the platform, is noted as an attribute that is linked to soft hammer percussion and the appearance of diffuse/weak bulbs. This attribute has been used within MSA lithics at KRM (Wurz 2000; Oberholzer 2021), however, this study has not formally recorded lipping as an attribute under analysis. Instead, it has been informally recorded on a handful of blanks so its presence in the assemblage could be noted. Lipping was identified when the technological analysis was being completed and not accurately assessed on every blank.

3.3.3 Method of reduction

Once the technique used to remove blanks from the core has been established, the next step of the *Chaîne Opératoire* is to assess the method used to reduce the core. The method entails the thought-out sequence of flake removals as the core is reduced (Tixier 2012). Both blanks and cores can be used to infer methods and techniques of reduction (Bar-Yosef & van Peer 2009). The complete or almost complete (based on their fragmentation analysis) blanks from the sample were analysed according to their technological category. This was done using bright natural light with both the naked eye and 10X magnification to assess the directionality of the dorsal flake scars. The relevant categories are unidirectional (parallel and convergent), bidirectional (parallel and convergent), crossed, and centripetal (adapted from Soriano *et al.* (2007) and Douze *et al.* (2015)), along with platform shaping (following Wurz 2000; Brenner 2019), *débordant*, and core management pieces. *Débordant* (Soriano *et al.* 2007; Douze *et al.* 2015) was used for core edge pieces (Brenner & Wurz 2019) specifically and core management pieces describe any other piece used in core maintenance activities. Cortex coverage of the blanks was also assessed to help understand the intensity of core reduction. This was assessed based on cortex, which relates to the type of raw material node, for example natural outcrop or cobble. This was recorded in six classes: absent, <25%, 25-50%, 50-75%, >75%, 100%.

The geometric attributes, side profile, and cross-section were also recorded as they may provide some insights into preferred core shape at the time when it was reduced as well as the shape of the core surface created by previous removals (after Tostevin 2012). Side profile refers to the possible convexity of a blank based on its shape when viewing the blank from the lateral margin. This attribute is helpful as it provides some evidence on the knapper's possible tendency to exploit core surfaces with specific convexities. The cross-section relates to the knapper's use of the dorsal ridges created by previous blank removals as *nervures guides* to determine how to use dorsal ridges to determine the shape of the blank (see Tostevin 2012). *Nervures guides* are understood as the dorsal ridges of previous removals and how those ridges inform the morphology of the next blank (Oberholzer 2021). The categories for both profile and cross-section draw on the categories set out in Tostevin (2012), however a smaller simplified classification has been employed. The profile categories employed in this study were straight, curved, and twisted. The cross-section categories employed were triangular, triangular asymmetrical, trapezoidal, trapezoidal asymmetrical, and flat. A final indeterminate category was employed in both the profile and cross-section analysis for blanks that could not be placed with these categories but met the requirements for assessment (as assessment was only carried out on complete or almost complete blanks).

Several metric attributes of the blanks were also recorded. Namely, the technological lengths, width, and thickness were recorded following Soriano *et al.* (2007). Finally, the individual weights of all the blanks >20mm as well as bladelets were recorded. This was done to assess any patterns and variation within the assemblage depending on blank type based on the blanks' dimensions.

Cores were assessed by recording the physical attributes, namely, material nodule (cobble, pebbles, or natural outcrop), length, width, and thickness (Shea 2020), and the percentage of cortex present (regarding cobbles and pebbles) as it may indicate different reduction decisions and technologies used by the knappers (Brenner & Wurz 2019). Following this, flake scars were counted to assess the extent of the core reduction (Shea 2020). Moore & Preston (2016) argue that these attributes can be used to infer technological classification of the cores. Core types were used following Conard *et al.* (2004) and Brenner and Wurz (2019) and are as follows: initial, parallel, incline, platform, multidirectional, bipolar, and indeterminate (Conard *et al.* 2004) as an initial classification, and then core types 1 through 5 as well as bladelet cores (Brenner & Wurz 2019). This has been done to assess the cores along the lines of a unified taxonomy that has been more widely used (in the case of Conard *et al.* (2004)) and makes an attempt to apply the core categories that have recently been applied to cores from other recently excavated layers (in the case of Brenner & Wurz (2019)).

3.3.3.1 Initial Cores

Initial cores represent a core in the first stages of reduction that possesses 5 or fewer removals on a reduction surface. Therefore, the vast majority of the core's surface remains intact and untouched (Conard *et al.* 2004).

3.3.3.2 Parallel Cores

Parallel cores consist of two surfaces where only one is a broad removal surface. This main removal surface must contain at least one major removal and usually contains several removals that must originate from the intersection plane between the active removal surface and the 'underside' surface where removals are made parallel to the intersection plane. Two other key attributes of the parallel core category are that the active removal surface is convex in nature and the cores are largely asymmetrical. The asymmetry is attributed to the fact that the 'underside' surface is either unworked or partially prepared. In the case that there is some preparation of the 'underside' surface, it is believed to be mutually exclusive of the working of the active removal surface. It should be noted that *Levallois* cores (Inizan *et al.* 1999) would fall into this category (Conard *et al.* 2004).

3.3.3.3 Incline Cores

Incline cores have two active removal surfaces where removals are initiated at around a 45º angle to the plane of intersection between these two surfaces. All major removals must have originated at the plane of intersection and may come from any point along the circumference of the core that is also at the plane of intersection between the two surfaces. Finally, removals usually converge to the centre of the core. The cores do not have to necessarily be bifacial or worked along the entire circumference to fall in this category, however, this category does include discoidal cores (Conard *et al.* 2004).

3.3.3.4 Platform Cores

Platform cores differ from parallel and incline cores as they do not possess the same plane of intersection between two surfaces as there is usually more than one narrow active removal surface and not a broad active surface as with the core types described above. There may be more than one developed striking platform that allows for multiple successful removals which have been removed side-by-side. Finally, the removal angle is usually close to 90º, as depicted in Figure 3.5 (Conard *et al.* 2004).

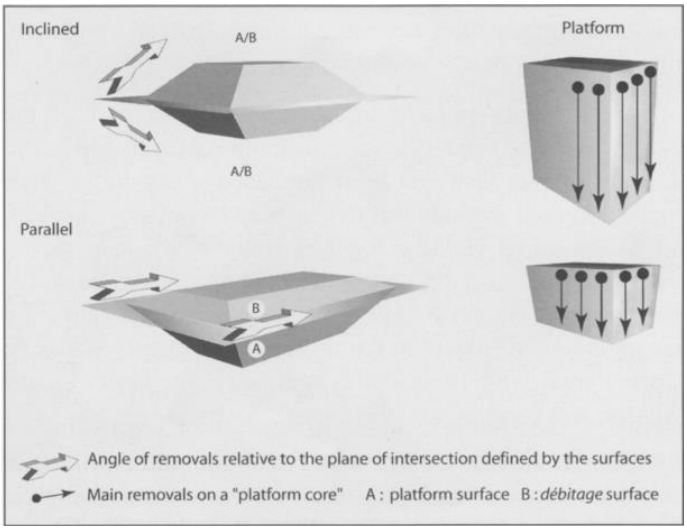


Figure 3.5 Visual representation of the first three core categories (parallel, inclined, and platform) (taken from Conard et al.et al. (2004)).

3.3.3.5 Multidirectional Cores

Multidirectional cores are argued to have removals that originate from three or more surfaces (therefore differentiating them from other core categories). The striking platforms and the removal surfaces do not necessarily have to be well developed, making these cores highly variable (Conard *et al.* 2004). Therefore, the key attribute is the number of surfaces and the directionality of the surfaces.

3.3.3.6 Bipolar Cores

The key attribute of bipolar cores is evidence of impact damage on the opposite of the core to the striking platform due to the core being placed on an anvil and then struck to remove a blank. This method of removal is prevalent in the knapping of quartz blanks (Conard *et al.* 2004).

3.3.3.7 Indeterminate Cores

Cores placed in the indeterminate category are cores that could not be accurately ascribed to any of the categories described above as they are fragmented or lack the distinctive attributes relating to their negative flake scars, morphology, and striking platforms (Conard *et al.* 2004).

3.3.3.8 Core types following Brenner and Wurz (2019)

Six core types were formulated by Brenner and Wurz (2019) in their analysis of MSA lithics from KRM. These types were employed alongside the other core typologies described above, as the two analyses are separate, to allow for a broader, more thorough comparison with the analysis of recently excavated overlaying layers at KRM. This allowed for better typological comparison of the core attributes through time of a broader MIS 5 period at KRM. Type 1 relates to platform cores and types 2 to 5 to parallel cores. The final type specifically relates to bladelet cores. Type 1 specifically refers to unidirectional platform cores that only possess one striking platform and 'semi-rotational' reduction on two adjacent surfaces, similarly to the platform cores described above. The parallel core types differ on scar pattern. Types 2 and 3 are 'flatter' cores with a single convex removal surface, similar to *Levallois* or *Levallois*-like technological approaches. Type 2 cores have a parallel removal pattern which is unidirectional with only one striking platform and no opposite or opposing platform. Type 3 cores also have unidirectional parallel removals; however, the core will have the striking platform for the main removals as well as an opposite or opposing platform.

Type 4 and 5 cores are also viewed are parallel cores, however, with an irregular scar pattern. Both types possess irregular short scar patterns when compared with types 1–3 where removals seem to be irregular flakes. Type 4 has been reduced in a unidirectional manner, whereas type 5 has been reduced bidirectionally and, thus, has two striking platforms. Finally, bladelet cores differ from all the previous types as they are cores that have several small bladelet scars that are adjacent to each other on an active surface. The core blank can also be chosen at random, therefore the blank may be a large flake, a previously exhausted core, or a large enough chunk (Brenner & Wurz 2019).

3.3.3.9 'End products' and blanks

Finally, blanks can be separated into preparational blanks (i.e., core management pieces removed while the core and active surface are prepared) and 'end products' following Brenner and Wurz (2019) and Douze *et al.* (2015). However, it should be noted that as researchers it may be impossible to understand or describe blanks in their true emic terms (Bar-Yosef & van Peer 2009), therefore 'end products' is used to describe several categories of blanks that are more or less regular in both shape and negative scar pattern on the dorsal surface (Damlien 2015).

3.3.4 Retouch, utilisation and discard

Andrefsky (2008) describes stone tools as lithics which are recognised to have either retouch or use-wear present. When discussing KRM MSA II/Mossel Bay material, Brenner *et al.* (2022) describe the presence of formal retouch and edge damage. Edge damage to the lithics is interpreted as taphonomic or use-wear damage which is beyond the scope of macro-fractures. Formal tools are recognised as tools which have undergone a particular 'extra effort' in their production to retouch or reshape flakes (Andrefsky 2008). Formal retouch is viewed as notching, denticulation, creating a scraper edge, and the intentional reworking of the edges of a lithic to resharpen it. These two categories were investigated using 10X magnification to assess the edges of the lithics to confirm or update the preliminary findings by Brenner *et al.* (2022) that formal tools are absent from the SBLS. The tool categories used in this study draw on previous work such as Douze *et al.* (2015) and are as follows: single clactonian notch, multiple clactonian notches, single retouched notch, multiple retouched notches, denticulate, scraper, burin, borer, and edge damaged. It is key to note that as with Douze *et al.* (2015), denticulate tools were separated from tools possessing multiple retouched notches based on where the notches are located. A denticulate is viewed as having notches continuously on the same edge or lateral margin. Finally, another category was added to further separate single retouched notch tools and multiple retouched notch tools. A category for a tool possessing two retouched notches was used thus meaning that multiple retouched notches applies to tools with three or more notches. This was done as a significant number of blanks possessed two notches.

In an attempt to assess the possible utilisation of the SBLS lithic material, a hypothetical approach was taken to determine a way in which the lithic points in the assemblage could depict decision making and behaviour in the past. This was done through TCSA as it can provide a hypothesis on what weapon delivery systems may have been used in the past based on the size of the point. Points were and are used for the analysis as it is widely believed that lithic points (or pointed blanks) have been used as hunting implements in the past. Previous TCSA (Lombard 2021a) on a sample of the SBLS lithics discussed by Brenner and Wurz (2019) has put forward a hypothesis that the median TCSA values for the lithic points from this layer are in the dart and javelin range (Lombard 2021a). To investigate this TCSA hypothesis, an extended TCSA was undertaken on the entirety of the convergent flakes that are deemed to be points following the measurement formula (0.5 x maximum width x maximum thickness of the lithic point) and then compared with the spear-thrower dart tip, javelin, arrowhead and larger thrusting spear categories employed by Lombard (2021a) and Lombard *et al.* (2022b).

However, it is important to note that TCSA is currently ineffective at distinguishing darts from the other weapon tip categories (Lombard *et al.* 2022b). Nevertheless, it provides for constructing robust hypotheses regarding arrow, javelin, and spear categories (Lombard 2021a; Lombard & Churchill 2022).

Utilisation of the points was further investigated through the assessment of macroscopic fractures on the lithic points sub-sample. The categories described by Fischer *et al.* (1984) and Lombard (2005a) were used to analyse the macro-fractures on the lithic material to better understand the possible uses for the lithics. The underlying premise of the macro-fracture study is that longitudinal (head-on) contact between lithic implements and other materials leads to the formation of impact fractures. Macro-fractures were assessed on all lithic points and broken point fragments in the assemblage for the appearance of diagnostic impact fractures (DIFs). Fischer *et al.* (1984) described cone fractures, bending fractures, and spin-off fractures in their analysis. Bending fractures are further separated into feather, step, hinge, snap, and embryonic terminating bending fractures. Following on from Fischer *et al.* (1984), Lombard (2005a) added impact burination as a fracture category. These categories were followed in this study and the relevant lithic material was assessed using the naked eye as well as X10 magnification from a hand lens. It should also be noted at this point that utilisation is inferred based on the edge damage and retouch but these results would have to be seen as preliminary and would need more confirmation through a detailed use-wear study.

The extent to which tools in an assemblage displays signs of retouch and use-wear has been used previously in research on the MSA II to infer the strategies around the discard of lithics (Thompson *et al.* 2010). The same approach has been employed to infer possible discard of the SBLS material. It has been argued that *Homo Sapiens* of the past may have made use of several strategies relating to the production of and discard of their tools. These strategies are not necessarily mutually exclusive and may have been changed both over time and across geographical areas (Thompson *et al.* 2010). Four strategies have been put forward by various authors (Binford 1979; Bleed 1986; Dibble 1987; Kelly 1988; Nelson 1991; Jeske 1992) and Thompson *et al.* (2010) have labelled these strategies as: expedient, maintainable, reliable, and efficient. This study has used the same terminology. An ‘expedient’ strategy involves the use of local raw materials as they are readily and easily available, therefore significant reuse of tools is not required as new tools could be easily manufactured. Maintainable and reliable strategies are based on theory drawn from engineering design and have been supported by ethnographic evidence (Bleed 1986). A maintainable strategy entails the use of tools that are light and portable, can be repaired and maintained while they are being used, and are easily repaired/maintained by the user. The !Kung San hunters provide a good ethnographic example for this strategy as their bow, arrow quiver, and spear can be carried by a single individual who can maintain or repair the respective parts of the tools while on the move (for example, the points used for the arrows or spear) (Bleed 1986). On the other hand, a reliable system relies on the use of well crafted, possibly 'over-designed' tools that can only be crafted and maintained by specialists in the groups to carry out tasks. The Nunamiut undertake encounter hunting where the vast majority of their meat resource is hunted in around 30 days that encapsulate Caribou migrations. Therefore, a highly reliable tool kit is required to ensure that they are as successful as possible in this short period. This is noted ethnographically where the toolkit is manufactured throughout the year in preparation for this short hunting season which includes the manufacturing of high quality tools, a specialised and specific repair kit which will be used to maintain the tools, as well as additional, redundant equipment which acts as contingency or insurance gear in the case that it is required (Bleed 1986). These two systems seem somewhat easier to assess from ethnographic sources and their broader utility when only analysing lithic material may be difficult to see. Finally, a strategy centred on efficiency can be understood as a strategy which focuses on energetic efficiency. The concept relies on the idea that humans have to make choice on how best, or efficiently, to allocate their energy to achieve particular subsistence tasks. Therefore, a tool kit (like lithics) can be affected and constrained in their design and usage depending on how much energy was contributed to the tools manufacturing and usage in a particular group's pursuit for energetic efficiency (see Jeske (1992) for an in-depth discussion and archaeological example).

3.3.5 Post-depositional attributes

Post-depositional attributes refer to factors that act on the lithics after they have been deposited within the layer. The two key areas that this study focuses on in this regard are fragmentation and encrustation.

3.3.5.1 Fragmentation

Fragmentation refers to the fracturing or breaking of the lithics due to forces that act upon the material following deposition. One of the major drivers behind this action is trampling (Fischer *et al.* 1984; Lombard & Pargeter 2008; Pargeter & Bradfield 2012). This trampling may have been caused by *Homo sapiens* as they continued to live in the same space that these lithics were discarded (in the same vein as the study using bovids by Pargeter & Bradfield (2012)) or from natural agents which includes compaction from overlying sediments (Reynard & Henshilwood 2018) or water infiltration (which may be seen as part of water action) (Tringham *et al.* 1974). Although Reynard and Henshilwood (2018) conducted their study on faunal material, Nielsen (1991) notes that processes such as trampling are an agent that acts on a wide array of artefacts. Therefore, sediment compaction or water action must also have an effect on lithics, even if to a lesser degree in the same vein as the trampling evidence put forward by Pargeter & Bradfield (2012) where lithic material was affected to a lesser degree by trampling processes than bone. The key point here is that several post-depositional processes could contribute to the creation of impact fractures on lithics, however most of these processes are not understood on lithics. Therefore, the focus is on trampling as some evidence for this process has been published. It is argued that DIFs like the ones described earlier may also be caused through the actions of trampling, however their frequency seems to be largely negligible in the experimental samples (3%) (Pargeter & Bradfield 2012). Fischer *et al.* (1984) assert that snap terminating bending fractures are the most frequent fractures produced by 'accidental processes' which include trampling. These snap fractures are, at times, accompanied by cone fractures and infrequent spin-off fractures. The fracture categories put forward by Fischer *et al.* (1984), which are used above for the macro-fracture analysis (Section 3.6.) are applied here to keep terminology and categorisation consistent.

3.3.5.2 Encrustation

Encrustation refers to the coating of the lithic surface by minerals and other biological growth which takes place post deposition (Pokines & Symes 2013). Encrusted material on lithic material seems to have received little study at this stage, particularly in the southern African MSA context. However, encrustation on bone has been an avenue of study (Pokines & Symes 2013; Fernández-Jalvo & Andrews 2016). This study has followed similar methodologies to the manner in which cortex coverage is assessed to assess encrustation alongside the other post-depositional attributes of fragmentation. An adjusted version of the 'percentage covered' methodology that has been applied to cortex coverage has been employed. This version drew on the approach employed by Wilkins *et al.* (2017). Four categories were used to assess the encrustation coverage ranging from (1) spotting to (2) <50% covered, (3) 51-90% covered, and (4) entirely covered.

3.4 Conclusion

The methodology described in this section outlined the roadmap to understanding the transformation of raw material to a culturally and technologically specific artefact. Through the analysis of these specific attributes, many results have been obtained which allows for a thorough discussion of the likely behaviours of *Homo sapiens* during their SBLS occupation. This methodology has drawn from several sources that have previously employed these approaches to infer the behaviours of the past based on lithic technology. The broad range of attributes provided for a thorough analysis of the lithic material.

CHAPTER 4 RESULTS

4.1 Introduction

The result of the lithic analysis follows the steps of the *Chaîne Opératoire* approach. The results are presented under the following sub-sections: the assemblage composition, raw material procurement, technique of blank removal, method of reduction followed by retouch, utilisation, and discard. Tip cross-sectional area analysis (TCSA) and the macro-fracture analysis are presented as part of the 'utilisation and discard' section at the end of this chapter. Beyond the figures found in this chapter which represent the wide variety of lithics that have been recovered from the SBLS, Appendix C contains furthers figures of the lithics and Appendix D has additional core drawings.

4.2 Sample

The studied sample comes from all the SBLS lithic material excavated in 2020 at KRM. This includes material from all squares (A1 to C3). The assemblage composition in relation to cores, flakes, blades, bladelets, points, chunks, chips, and hammerstones (cf. Brenner & Wurz 2019) is provided below (Table 2). These classifications relate to the 'basic category' that is first assigned to each lithic blank as the first step of technological analysis following the raw material classification. This Table shows that quartzite dominates the assemblage as this raw material makes up 97% (n=6343) of all the lithic material recovered. Of this 97%, coarse grained quartzite makes up 52% (n=3374) of the entire sample, and fine-medium grained quartzite 45% (n=2969). Only two other raw materials contribute more than 1% to the assemblage composition, quartz (1,4%, n=94) and sandstone (1,4%, n=86). Hornfels and silcrete make up 11 lithics (0,2%). There are 891 plotted lithics that are >20mm and the assemblage contains 11 cores.

Table 2. The composition of the 2020 SBLS assemblage. Flakes <20mm include both complete flakes and flake fragments.

	Blade	**Bladelet**	**Point**	**Flake**	**Indeterminate**	**Hammerstone**	**Cores**	**Chunks >20mm**	**Fragment**	**Total >20mm**	**Flakes (<20mm)**	**Chunks**	**Chips**	**Shaping Flakes**	**Total <20mm**	**Grand Total**
Hornfels																
n	0	1	1	0	0	0	0	0	0	2	0	0	0	2	2	4
%	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Indeterminate																
n	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	2
%	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Quartz																
n	2	0	0	3	2	0	0	0	1	8	14	12	45	15	86	94
%	0,0	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,1	0,2	0,2	0,7	0,2	1,3	1,4
Quartzite Coarse grained																
n	78	8	12	198	62	4	6	5	46	419	556	477	1730	192	2955	3374
%	1,2	0,1	0,2	3,0	0,9	0,1	0,1	0,1	0,7	6,4	8,5	7,3	26,5	2,9	45,2	51,6
Quartzite Fine-Medium grained																
n	120	31	28	155	68	1	5	3	44	455	500	245	1534	235	2513	2969
%	1,8	0,5	0,4	2,4	1,0	0,0	0,1	0,1	0,7	7,0	7,6	3,7	23,5	3,6	38,4	45,4
Sandstone																
n	1	0	0	0	0	0	0	0	1	2	10	24	50	0	84	86
%	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,4	0,8	0,0	1,4	1,4
Silcrete																
n	0	0	2	1	0	0	0	0	0	3	3	0	0	2	5	8
%	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1
N	**202**	**40**	**43**	**357**	**133**	**5**	**11**	**8**	**92**	**891**	**1083**	**758**	**3358**	**446**	**5645**	**6537**
%	**3,1**	**0,6**	**0,7**	**5,5**	**2,0**	**0,1**	**0,2**	**0,1**	**1,4**	**13,7**	**16,6**	**11,6**	**51,4**	**6,8**	**86,4**	**100,0**

In Table 3 the lithic densities of all squares of the 2020 SBLS sample are provided and compared to the lithic densities of other squares within this sample. 32,6 litres of deposit were excavated in 2020, and the density of the lithics per litre is 415,3 lithics for material >20mm and 2453,4 lithics per litre for all lithic material. By weight, square A1 has provided the largest percentage of the sample (25%, 2759,6g), while squares B2 (15%, 1667,3g), A2 (14,5%, 1624,4g) and B1 (14%, 1574,8g) follow respectively. The volume of deposit excavated totals to 0,033 m^3, with the biggest contributors being squares B2 (0,009m^3) and A3 (0,005m^3). Material labelled B2/A2 was retrieved along the boundary between squares A2 and B2. This study has not relied on spatial data, therefore these lithics have been recorded here as they were originally assigned to this additional category and is thus excluded from having data on removed sediment.

Table 3. Lithic count and weights per square in the SBLS layer.

Square	**Weight (g)**	**Weight (%)**	**Litres of excavated deposit**	**Volume of deposit excavated (m^3)**	**All lithics**	**Density of all lithics per litre**
A1	2759,6	24,7	0,8	0,001	594	742,5
A2	1624,4	14,5	5	0,005	797	159,4
A3	779,4	7,0	2	0,002	309	154,5
B1	1574,8	14,1	4,3	0,004	1021	237,4
B2	1667,3	14,9	9	0,009	1234	137,1
B2/A2	44,6	0,4	-	-	5	-
B3	1365,5	12,2	2	0,002	902	451,0
C1	316,1	2,8	3,5	0,004	432	123,4
C2	390,9	3,5	2	0,002	356	178,0
C3	613,6	5,5	4	0,004	882	220,5
No Square	58,3	0,5	-	-	4	-
Grand Total	11194,5	100,0	32,6	0,033	6536	2403,8

4.2 Raw material procurement

Raw material procurement is represented in both Tables 2 and 4. Table 2 contains the assemblage composition in relation to raw material, whereas Table 4 contains all lithics in the respective raw material categories irrespective of blank type for simple reference. More than 97% of the sample is made from quartzite (either coarse or fine-medium grained). Quartzite is described by Cairncross (2004) as metamorphosed sandstone that has a high quartz content and it has been widely identified at KRM. The remainder consists of silcrete, hornfels, quartz or sandstone, where no single material accounts for more than 1,5%. The sandstone determination (n=86) was made for two reasons, firstly as several lithics seem closer to sandstone than quartzite as although these lithics possessed some amount of quartz grains the metamorphism did not seem to be to the same degree as the other 'quartzite' pieces, or secondly the material resembles the Table Mountain sandstone of the Cape supergroup which is the mother rock of the cave/rock shelter at KRM (Brenner & Wurz 2019). Finally, two lithics have been assessed as indeterminate. This was done as the encrustation on the lithics' surface is so extensive that an accurate determination could not be made. There does not seem to be a clear preference for finer or coarser grained quartzites as there is a 6% difference between the amount of coarser grained to finer grained quartzite material.

The assemblage composition (Table 2) has provided an interesting picture regarding the presence of coarse- and fine-grained quartzite. Overall, coarse-grained quartzite makes up the majority of the quartzite material (n=3374, n=52%) and although the values of both ‘granularities’ of quartzite are similar, the fine-medium grained quartzite is better represented in the >20mm sub-sample (7%, n=455) than coarse-grained quartzite (6%, n=419). Focusing on the <20mm material, there are more coarse-grained chips and chunks (34%, n=2207) compared to fine grained chips and chunks (27%, n=1779). There are more shaping flakes adjudged to be fine-medium grained quartzite (nearly 4%, n=235) as opposed to coarse grained quartzite (nearly 3%, n=192). Flakes <20mm, shaping flakes and chips have been identified in all the raw material which have provided blanks >20mm (i.e. hornfels, quartz, quartzite (fine and coarse grained), and silcrete). For Hornfels and Silcrete the numbers of all three categories are low (n=>3), however the quartz and quartzite categories seem to present a similar pattern that chips outnumber the flakes <20mm and shaping flakes significantly. The same is seen in both quartzite categories. With regard to coarse-grained quartzite there are 1730 chips (26,5%) to 556 flakes <20mm (8,5%) and 192 shaping flakes (2,9%). With regard to the fine to medium-grained quartzite, there are 1534 chips (23,5%) to 500 flakes <20mm (7,6%) and 235 shaping flakes (3,6%). Although less of the sample consists of fine to medium-grained quartzite (45,4%) compared with the coarse-grained (51,6%), more shaping flakes are made from fine to medium-grained (n=235, 3,6%) as opposed to coarse-grained (n=192, 2,9%).

Table 4. Raw material composition of the SBLS assemblage.

Rock Type	**Number of lithics (n)**	**Percentage (%)**
Quartzite (coarse grained)	3374	51,6
Quartzite (fine-medium grained)	2969	45,4
Silcrete	8	0,1
Quartz	94	1,4
Hornfels	4	0,1
Sandstone	86	1,4
Indeterminate	2	0,1
	6537	100,0

4.3 Technique of flake removal

Lithic blanks that possessed platforms could be analysed for several characteristics including type of platform, preparation, platform angle, bulb of percussion and platform length and width. During analysis, 576 blanks were judged to present a platform and at least some of the associated characteristics. This is due to fragmentation which, at times, did not allow for length and width measurements to be taken.

4.3.1 The type of platform, platform preparation, and bulb of percussion

Platforms were identified on 576 lithics that could be classified according to several categories following Inizan *et al.* (1999) with the aforementioned adjustments described in Chapter 3 (Figure 3.2). Along with specific platform type, which relates to the specific faceting or lack thereof of the platform surface, platform preparation (largely seen as thinning of the platform or rounding of its edge) is also recorded. Plain (39%, n=226) and facetted unspecific (nearly 27%, n=153) platforms are the two most abundant categories in the sample, facetted platforms are the last of the major platform configurations at 14% (n=82) with no other category making up more than 7% of the remaining sample (Table 5). This seems to indicate a specific tendency to create platforms such as plain and unspecific and specific faceting.

Table 5. Platform type and preparation in the SBLS on blanks >20mm.

Platform	**Rubbed (n)**	**%**	**Trimmed (n)**	**%**	**Rubbed/ Trimmed (n)**	**%**	**No Preparation (n)**	**%**	**Total (n)**	**Total (%)**
Broken	2	0,3	5	0,9	0	0,0	31	5,4	**38**	**6,6**
Cortical	1	0,2	4	0,7	0	0,0	20	3,5	**25**	**4,3**
Chapeau De Gendarme	0	0,0	1	0,2	0	0,0	1	0,2	**2**	**0,3**
Dihedral	0	0,0	3	0,5	0	0,0	7	1,2	**10**	**1,7**
Dihedral unspecific	1	0,2	4	0,7	1	0,2	7	1,2	**13**	**2,3**
Facetted	13	2,3	29	5,0	3	0,5	37	6,4	**82**	**14,2**
Facetted unspecific	30	5,2	34	5,9	2	0,3	87	15,1	**153**	**26,6**
Indeterminate	2	0,3	4	0,7	1	0,2	11	1,9	**18**	**3,1**

Table 5 (continued). Platform type and preparation in the SBLS on blanks >20mm.										
Linear	1	0,2	1	0,2	1	0,2	2	0,3	**5**	**0,9**
Plain	28	4,9	56	9,7	13	2,3	129	22,4	**226**	**39,2**
Plain (With localised depression)	0	0,0	0	0,0	0	0,0	1	0,2	**1**	**0,2**
Shattered	0	0,0	0	0,0	0	0,0	2	0,3	**2**	**0,3**
Winged	0	0,0	1	0,2	0	0,0	0	0,0	**1**	**0,2**
Grand Total	**78**	**13,5**	**142**	**24,7**	**21**	**3,7**	**335**	**58,2**	**576**	**100,0**

Table 6 compares platform preparation in relation to prominent blank types and the platform types present in the assemblage. Blades (54,9%), bladelets (73,7%), and flakes (57,8%) all had a majority of blanks with no preparation. Points on the other hand, present the opposite, where only 29,6% of point blanks have no platform preparation. The presence of these three categories (rubbing, trimming, and both rubbing and trimming) are presented below on the most notable platform types (the platform type is only displayed if preparation was present) and is best represented in table 6 below.

Table 6. Platform preparation per blank type and platform.

Attribute	**Number (n)**	**%**
Blade	**122**	**30,1**
Rubbed	**22**	**18,0**
Facetted Platform	3	13,6
Facetted unspecific platform	11	50,0
Plain platform	8	36,4
Trimmed	**28**	**23,0**
Facetted Platform	9	32,1
Facetted unspecific platform	7	25,0
Plain platform	12	42,9
Trimmed & rubbed	**5**	**4,1**
Facetted Platform	1	20,0
Facetted unspecific platform	1	20,0
Plain platform	3	60,0
No preparation	**67**	**54,9**
Facetted Platform	17	25,4
Facetted unspecific platform	26	38,8
Plain platform	24	35,8
Bladelet	**19**	**4,7**
Rubbed	**1**	**5,3**
Facetted unspecific platform	1	100,0

Table 6 (continued). Platform preparation per blank type and platform.

Trimmed	**4**	**21,1**
Facetted unspecific platform	1	25,0
Plain platform	3	75,0
No preparation	**14**	**73,7**
Facetted Platform	1	7,1
Facetted unspecific platform	5	35,7
Plain platform	8	57,1
Flake	**237**	**58,5**
Rubbed	**33**	**13,9**
Facetted Platform	7	21,2
Facetted unspecific platform	11	33,3
Plain platform	15	45,5
Trimmed	**60**	**25,3**
Facetted Platform	10	16,7
Facetted unspecific platform	20	33,3
Plain platform	30	50,0
Trimmed & rubbed	**7**	**3,0**
Facetted Platform	1	14,3
Facetted unspecific platform	1	14,3
Plain platform	5	71,4
No preparation	**137**	**57,8**
Facetted Platform	11	8,0
Facetted unspecific platform	44	32,1
Plain platform	82	59,9
Point	**27**	**6,7**
Rubbed	**5**	**18,5**
Facetted Platform	1	20,0
Facetted unspecific platform	3	60,0
Plain platform	1	20,0
Trimmed	**13**	**48,1**
Facetted Platform	5	38,5
Facetted unspecific platform	1	7,7
Plain platform	7	53,8
Trimmed & rubbed	**1**	**3,7**
Plain platform	1	100,0
No preparation	**8**	**29,6**
Facetted Platform	4	50,0
Facetted unspecific platform	3	37,5
Plain platform	1	12,5
Grand Total	**405**	**100,0**

When taking ‘end product’ blanks into account a different view of platform morphology is provided. Percentages are calculated on the totals of each blank type against platform type (Table 7). As discussed above, facetted (both specifically and non-specifically) and plain platforms form the majority of the types found in the assemblage, however these ratios differ depending on the lithic blank. Blade blanks have mostly plain (34,1%) and facetted unspecific (32,6%) platforms, followed by specifically facetted (21,7%) platforms. Bladelets appear to mostly have two types of platforms, plain (50%) and facetted unspecific (31,8%) platforms. A similar trend is seen with flakes where platforms are mostly either plain (42,2%) or un-specifically facetted (24,3%). Facetted platforms for these two blank types do not exceed 10% (bladelets 4,5% and flakes 9,3%). Finally, although the sample of points with proximal ends is small (n=31), both plain and specifically facetted platforms are well represented (both at 32,3%) followed by un-specifically facetted platforms (22,6%). The remaining percentages for the other platform types of all the blanks are negligible.

Table 7. Platform type per ‘end product" blank. The grand total is lower than table 4 as other blank types have been excluded here.

	Blade (n)	**%**	**Bladelet (n)**	**%**	**Flake (n)**	**%**	**Point (n)**	**%**	**Total (n)**	**Total %**
Broken	8	5,8	3	13,6	22	7,0	2	6,5	35	6,9
Cortical	2	1,4	0	0,0	21	6,7	0	0,0	23	4,6
Chapeau De Gendarme	1	0,7	0	0,0	0	0,0	0	0,0	1	0,2
Dihedral	0	0,0	0	0,0	10	3,2	0	0,0	10	2,0
Dihedral unspecific	4	2,9	0	0,0	5	1,6	1	3,2	10	2,0
Facetted	30	21,7	1	4,5	29	9,3	10	32,3	70	13,9
Facetted unspecific	45	32,6	7	31,8	76	24,3	7	22,6	135	26,8
Indeterminate	0	0,0	0	0,0	12	3,8	1	3,2	13	2,6
Linear	0	0,0	0	0,0	3	1,0	0	0,0	3	0,6
Plain	47	34,1	11	50,0	132	42,2	10	32,3	200	39,7
Plain (With localised depression)	1	0,7	0	0,0	0	0,0	0	0,0	1	0,2
Shattered	0	0,0	0	0,0	2	0,6	0	0,0	2	0,4
Winged	0	0,0	0	0,0	1	0,3	0	0,0	1	0,2
Column Totals	**138**	100,0	**22**	100,0	**313**	100,0	**31**	100,0	**504**	100,0

Table 7 provides an overview of bulbs of percussion and blanks compared to platform type. As described below, three bulb types are most numerous (negative, prominent, and weak). It should also be noted that the total number here is smaller than above and in Table 8 as only point, blade, bladelet and flake blank types are included.

Bulbs of percussion were identified on 574 lithics >20mm (Table 8). The three most prominent categories of prominent, weak and negative bulbs are all well represented in the sample. Weak bulbs make up 44% (n=255) of the sample, followed by negative bulbs (27%, n=157) and prominent bulbs (26%, n=149). The other three categories of broken, no bulb and indeterminate only make up 2,2% of the sample and, therefore, seem to be negligible. As described in chapter 3, lipping was informally recorded. Lipping was identified on 19 blanks, although the true extent of lipping in the assemblage cannot be assessed here, it is at least possible to note that it is present in the SLBS. It was noted on blanks with weak (n=14), prominent (n=2), negative (n=2), and no bulb (n=1).

Table 8. Bulb of percussion

Type of Bulb	**Number**	**Percentage (%)**
Broken	2	0,3
Indeterminate	8	1,4
Negative Bulb	157	27,4
No Bulb	3	0,5
Prominent Bulb	149	26,0
Weak Bulb	255	44,4
Grand Total	**574**	**100,0**

As set out in Table 9, blades have been manufactured on plain (10,8%) and un-specifically facetted (9,8%) platforms. The most numerous bulb types for blades are negative (11%) and weak (11,4%) bulbs which are more or less equal (Table 9). Bladelets mimic this trend with facetted unspecific (1,4%) and plain (2,3%) platforms, however bulbs are somewhat similarly represented with both negative and prominent bulbs (both at 1,1%) and weak bulbs (1,6%).

Flakes are the best represented blank type here, making up nearly 61% of the sample. Flakes, again, similarly have been removed using plain (29,1%) and facetted unspecific (16,9%) striking platforms (Table 9). 27,5% of flakes possess weak bulbs, followed by prominent bulbs (17,4%) and negative bulbs (16%). Interestingly, points differ by having a same number manufactured on both facetted and plain platforms (2,3%, n=10), followed by facetted unspecific (1,6%). 3% (n=13) points have prominent bulbs, followed by negative (2,1%, n=9) and then weak (1,4%, n=6) bulbs.

Table 9. Bulbs of percussion compared with the more numerous platform types and notable blank types.

	Cortical	**%**	**Dihedral**	**%**	**Dihedral unspecific**	**%**	**Facetted**	**%**	**Facetted unspecific**	**%**	**Plain**	**%**	**Total**	**%**
Blade	**2**	**0,5**		**0,0**	**4**	**0,9**	**30**	**6,9**	**43**	**9,8**	**47**	**10,8**	**126**	**28,8**
Negative Bulb	2	0,5	0	0,0	2	0,5	12	2,7	15	3,4	17	3,9	48	11,0
Prominent Bulb	0	0,0	0	0,0	1	0,2	9	2,1	8	1,8	10	2,3	28	6,4
Weak Bulb	0	0,0	0	0,0	1	0,2	9	2,1	20	4,6	20	4,6	50	11,4
Bladelet	**0**	**0,0**	**0**	**0,0**	**0**	**0,0**	**1**	**0,2**	**6**	**1,4**	**10**	**2,3**	**17**	**3,9**
Negative Bulb	0	0,0	0	0,0	0	0,0	0	0,0	2	0,5	3	0,7	5	1,1
Prominent Bulb	0	0,0	0	0,0	0	0,0	0	0,0	2	0,5	3	0,7	5	1,1
Weak Bulb	0	0,0	0	0,0	0	0,0	1	0,2	2	0,5	4	0,9	7	1,6
Flake	**21**	**4,8**	**10**	**2,3**	**5**	**1,1**	**29**	**6,6**	**74**	**16,9**	**127**	**29,1**	**266**	**60,9**
Negative Bulb	7	1,6	3	0,7	1	0,2	8	1,8	22	5,0	29	6,6	70	16,0
Prominent Bulb	5	1,1	4	0,9	2	0,5	9	2,1	23	5,3	33	7,6	76	17,4
Weak Bulb	9	2,1	3	0,7	2	0,5	12	2,7	29	6,6	65	14,9	120	27,5
Point	**0**	**0,0**	**0**	**0,0**	**1**	**0,2**	**10**	**2,3**	**7**	**1,6**	**10**	**2,3**	**28**	**6,4**
Negative Bulb	0	0,0	0	0,0	0	0,0	4	0,9	3	0,7	2	0,5	9	2,1
Prominent Bulb	0	0,0	0	0,0	1	0,2	6	1,4	2	0,5	4	0,9	13	3,0
Weak Bulb	0	0,0	0	0,0	0	0,0	0	0,0	2	0,5	4	0,9	6	1,4
Grand Total	**23**	**5,3**	**10**	**2,3**	**10**	**2,3**	**70**	**16,0**	**130**	**29,7**	**194**	**44,4**	**437**	**100,0**

4.3.2 The platform angle

Table 10 provides all the data on external platform angle in the respective intervals. The 80-89º interval is the largest grouping in the sample, making up nearly 52% (n=287). The only two other notable intervals are 70-79º (17,5%, n=97) and 90-99º (nearly 21%, n=115). The other categories account for 6% or less of the sample and seem to largely be outliers (accounting for 21 of the 554 lithics in the sub-sample presenting platform attributes).

Table 10. The external platform angles present in the platform sub-sample for blanks>20mm

Angle interval	Number	Percentage of sample (%)
50-59	7	1,3
60-69	34	6,1
70-79	97	17,5
80-89	287	51,8
90-99	115	20,8
100-109	9	1,6
110-120	5	0,9
Grand Total	**554**	**100,0**

4.3.3 The platform length and thickness characteristics

Both the length and thickness values varied widely across the sample ranging from sizes as small as 2,7mm and 1,6mm to as large as 61,1mm and 31,4mm respectively (Table 11). The mean for the platform length is 17,1mm and the mean for platform thickness is 6,8mm. The coefficient of variation shows the relative dispersion of data points in relation to the sample mean. Both platform length and width have a coefficient of variation of 50%, indicating that the standard deviations are half that of the mean. However, the importance of the coefficient is that it indicated here that the relative deviation from the mean for both platform length and width is the same. This, perhaps, indicates a relationship between the sizes where smaller platform lengths are paired with smaller platform widths in a proportional manner.

Table 11. Platform length and width calculations for blanks >20mm

Statistic	Platform Length (mm)	Platform Thickness (mm)
Mean	17,1	6,8
Standard Deviation	8,2	3,4
Coefficient of variation	50%	50%
Median	16,3	6,1
Minimum	2,7	1,64
Maximum	61,1	31,4
Number (n)	**539**	**558**

Both figures 4.1 and 4.2 illustrate that the datasets of the values for platform length and width are positively skewed. This means that the majority of values are clustered together closer to the lower end of the values in the dataset.

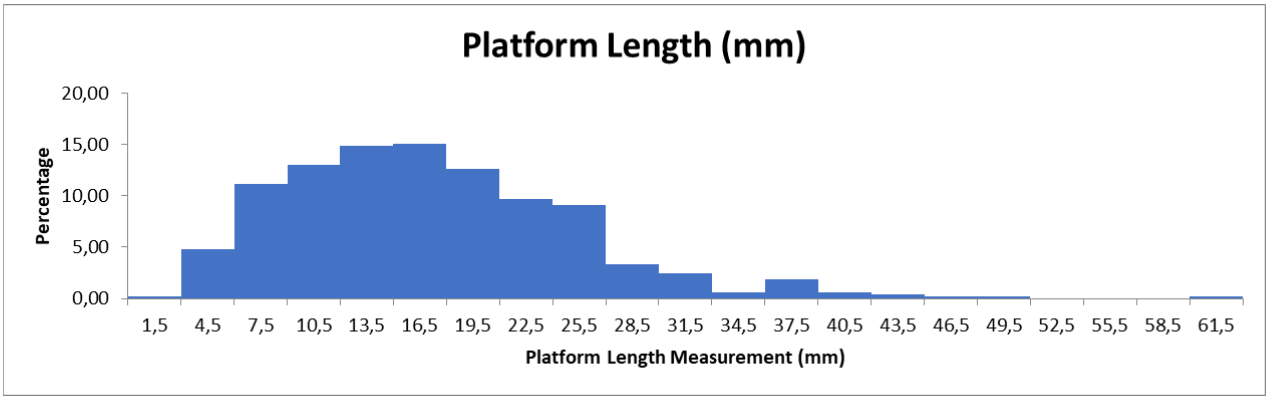


Figure 4.1 The distribution of platform lengths (mm). This indicates a positive skew in the distribution.

In Figure 4.1 we see the distribution of the SBLS platform lengths (in mm). 49,3% of the platform length values fall between 9,7mm and 20,2mm. While most of the data are clustered around the lower end of the values obtained, one large outlier was present in the form of a single blank that had a platform length of 61mm.

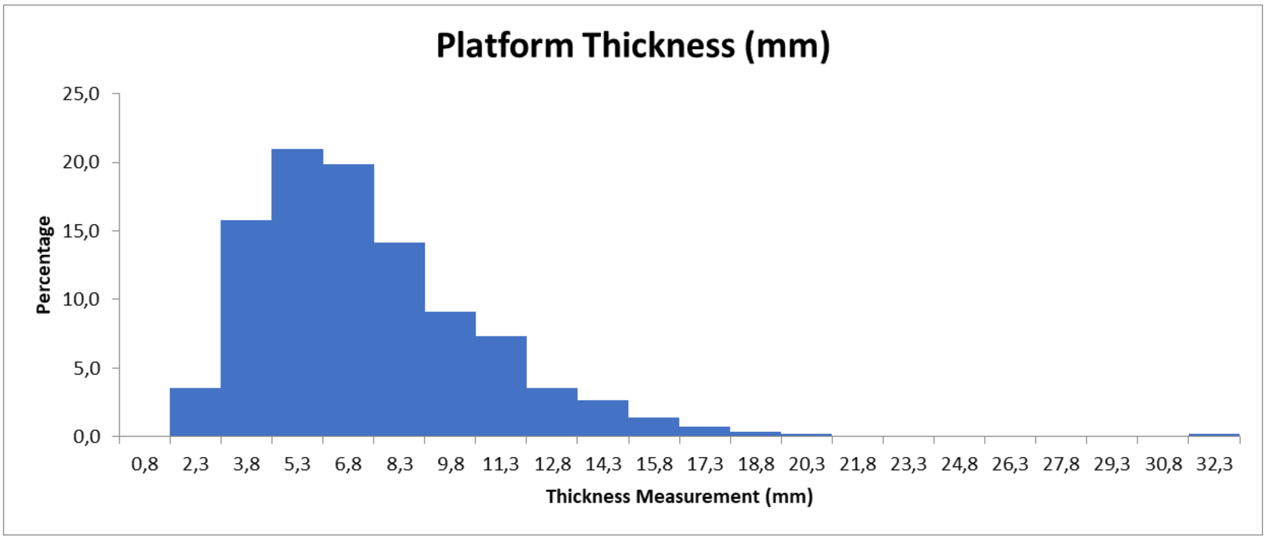


Figure 4.2 The distribution of platform widths (mm). This indicates a positive skew in the distribution.

Figure 4.2 displays the distribution of the platform thicknesses. The data are more tightly clustered than that of the platform lengths (Figure 4.1). 70,8% of the values fall between 4,6mm and 9mm. Again, there is one major outlier in the single blank with a platform thickness of 31,4mm.

4.4 Method of reduction

Both attributes of flake blanks and the cores can be used to infer information on the possible method used to reduce cores. First the cores were assessed to determine what type of cores were used in the reduction sequence. Following this, reduction based on the technological category and geometric attributes of complete or almost complete blanks >20mm was assessed. Finally, the morphology and metric attributes of 'end products' and blanks were discussed.

4.4.1 Cores and their technology

As with the flake scars that give insight into the directionality of flake removals and thus, core reduction, the SBLS cores themselves assist in providing further data. The sample is small (n=11); however, several cores provide significant information on removal directionality. Table 12 sets out the general dimensions of the cores. The 5 cores that make up the indeterminate and flake categories do not provide much information as there are limited flake scars and most are fragmented. The 6 cores on cobble blanks provided information on possible reduction sequences. Figures 4.3 and 4.4 provide views of all the relevant faces of four cores from the SLBS sample. These figures provide examples of several reduction approaches that have been found in the SBLS.

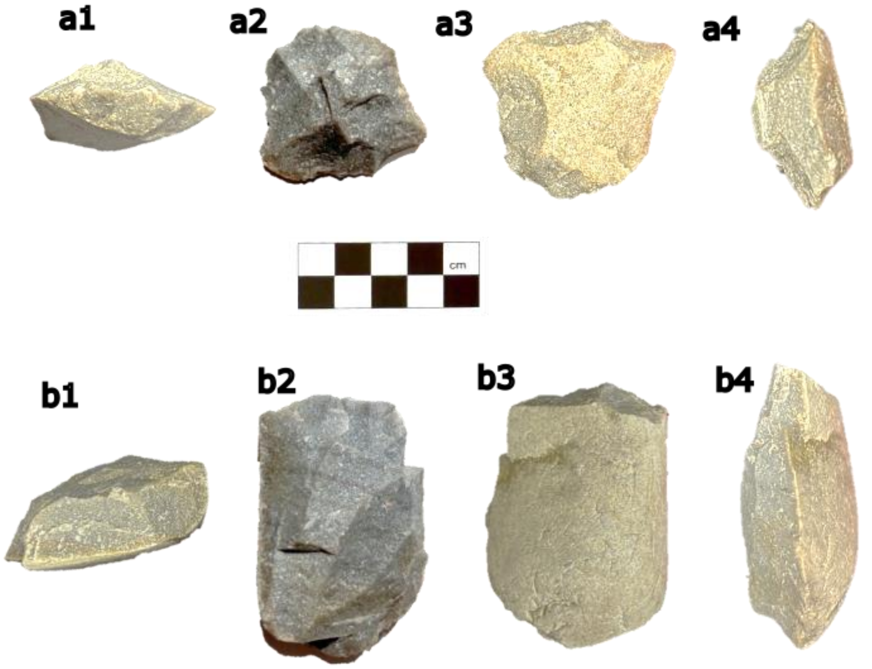


Figure 4.3 A parallel core (a) and a bipolar core (b) present in the SBLS. The parallel core displays bidirectional working, and the bipolar core seems to have anvil damage opposing the striking platform. (1) is the platform, (2) is the active surface, (3) is the ventral surface, and (4) is the lateral view of the core.

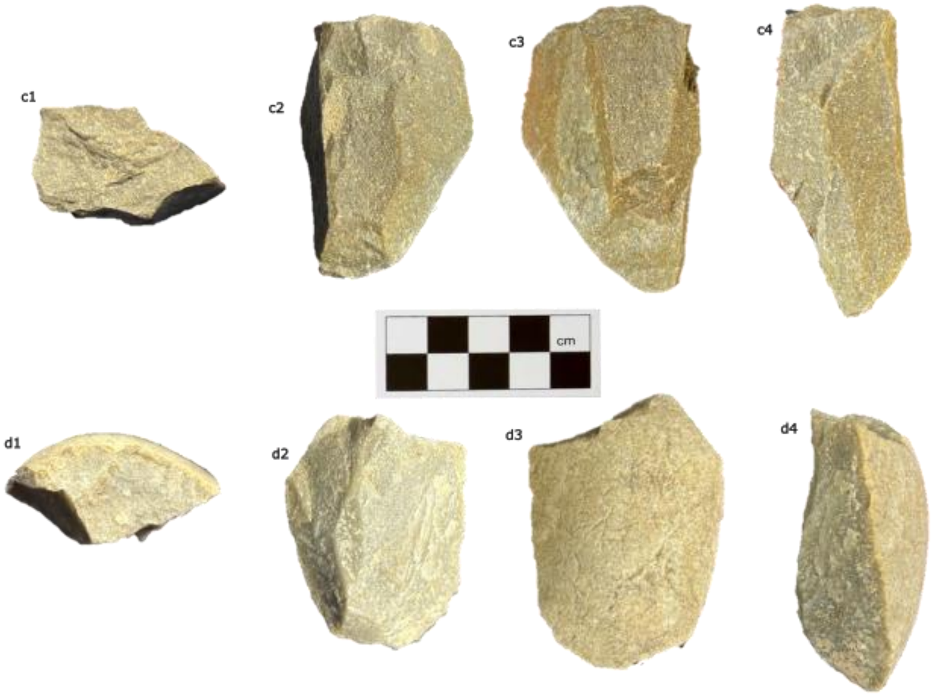


Figure 4.4 c & d represent the unidirectional parallel cores in the sample. These cores are only worked on a single active surface. 1 represents the respective cores' platforms, from where blanks were struck. 2 represents the active surface. 3 represents the unworked ventral surface. 4 represents the lateral view.

The most abundant blank type for the cores is cobble blanks (Table 12). Cobble blanks are generally the heaviest blanks; however, they are the most complete. Flake blanks are on average longer (65,8mm) and wider (49,4mm).

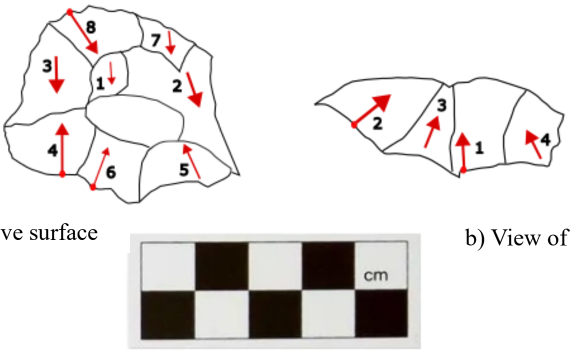
Table 12. The SBLS core sub-sample.

Core Blank	**n**	**Mean Length (mm)**	**Mean Width (mm)**	**Mean Thickness (mm)**	**Mean Weight (g)**
Cobble	6	57,8	48,8	25,8	87,7
Flake	3	65,8	49,4	25,2	56,5
Indeterminate	2	51,6	41,1	19,0	54,1
Total	**11**	**58,9**	**47,6**	**24,4**	**73,1**

Following the core types set out by Conard *et al.* (2004), 36,4% (n=4) of the cores in the sample are judged to fall under the 'parallel' category; this includes 4 of the cobble cores. Followed by 1 multidirectional (9,1%) and 1 bipolar (9,1%) core. The remainder are largely fragmentary and cannot be accurately classified. Table 13 focuses solely on the attributes of the 6 cobble cores. Negative scars were identified on the cobble cores with cores having between 7 and 15 scars. Following Brenner and Wurz (2019), the cores have been adjudged to fall into type 3 (n=1) and type 5 (n=4). One core could not be confidently classified within this system. Cortex that is present on these 6 cores has also been analysed and no core has more than 50% cortex coverage. These cores are also the only cores with cortex as the five other cores are largely fragmentary or flakes.

Table 13. flake scars and core type.

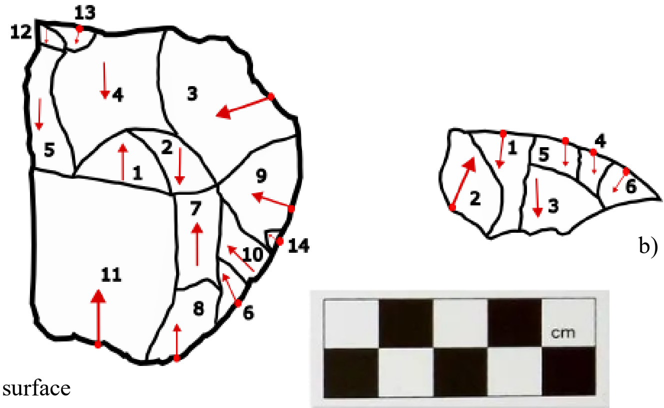
Core plot Number	**Flake Scars (n)**	**Core type** (Conard *et al.* 2004)	**Core type** (Brenner & Wurz 2019)	**Cortex present (%)**
9370	13	Bipolar	5	40
10061	7	Parallel	-	30
10116	9	Multidirectional	5	10
10228	8	Parallel	5	40
10741	15	Parallel	5	40
11000	8	Parallel	3	50



a) View of the active surface

b) View of the primary platform

Figure 4.5 Drawing of core #10061, displaying the largely bidirectional removals on this heavily reduced core as well as the four removals to prepare the striking platform.



b) View of the primary platform

a) View of the active surface

Figure 4.6 Drawing of core #10288, displaying the multidirectional removals on this heavily reduced core as well as the six removals to prepare the striking platform that are also made from two directions.

Figures 4.5 and 4.6 are drawings of cores to illustrate the directionality identified in the SBLS sample. The cores represented above are bidirectional and multidirectional to illustrate the differences between the two orientations. Both cores possess substantial flake scars (further core drawings available in Appendix D).

4.4.2 Technological category and cortex

The method of reduction with regard to the technological category, relates to the pattern of flake scars present on complete or almost complete lithics (Table 14). It provides some indication of the pre-planned sequence of flake removals as the core is reduced. The complete or almost complete flake blanks consist of a sub-sample of 316. Core management pieces account for the largest technological category (nearly 47%, n=146)). The three next biggest categories are unidirectional parallel (11%, n=35), *débordant* (including the cortical category, 9,8%, n=31) and bidirectional (including bidirectional convergent, nearly 15%, n=46). Other categories are negligible with no category accounting for much more than 6% of the sample.

Table 14. Technological categories denoting the trends of flake removals based on the flake scars present on the lithics.

Technological category	**Blades (n)**	**%**	**Bladelets (n)**	**%**	**Flakes (n)**	**%**	**Indeterminate (n)**	**%**	**Point (n)**	**%**	**Total**	**%**
Bidirectional	11	3,5	2	0,6	12	3,8	0	0,0	3	0,9	**28**	**8,9**
Bidirectional Convergent	3	0,9	0	0,0	7	2,2	0	0,0	8	2,5	**18**	**5,7**
Bipolar	2	0,6	0	0,0	1	0,3	0	0,0	0	0,0	**3**	**0,9**
Core Management	8	2,5	0	0,0	139	44,0	1	0,3	0	0,0	**146**	**46,8**
Cortical *Débordant*	0	0,0	0	0,0	2	0,6	0	0,0	0	0,0	**2**	**0,6**
Débordant	14	4,4	1	0,3	14	4,4	0	0,0	0	0,0	**29**	**9,2**
Entame	0	0,0	0	0,0	4	1,2	0	0,0	0	0,0	**4**	**1,2**
Indeterminate	1	0,3	0	0,0	2	0,6	2	0,6	0	0,0	**5**	**1,6**
Multidirectional	1	0,3	0	0,0	3	0,9	0	0,0	0	0,0	**4**	**1,3**
Platform Shaping	0	0,0	0	0,0	15	4,7	1	0,3	0	0,0	**16**	**5,0**
Unidirectional (With lateral cortex)	0	0,0	1	0,3	0	0,0	0	0,0	0	0,0	**1**	**0,3**
Unidirectional (with distal cortex)	1	0,3	0	0,0	0	0,0	0	0,0	0	0,0	**1**	**0,3**
Unidirectional Convergent	6	1,9	0	0,0	0	0,0	0	0,0	15	4,7	**21**	**6,6**
Unidirectional Parallel	13	4,1	5	1,6	13	4,1	0	0,0	5	1,6	**35**	**11,4**
Grand Total	**60**	**19,0**	**9**	**2,8**	**212**	**67,1**	**4**	**1,3**	**31**	**9,8**	**316**	**100,0**

Table 15 displays the dorsal scarring patterns that provide the best opportunity in understanding the removal orientation of blanks from the core. In this sub-sample, unidirectional orientations account for the largest categories where unidirectional parallel accounts for 30,2% (n=35) and unidirectional convergent accounts for 18,1% (n=21). In total, all unidirectional categories together account for 50% of the sub-sample (n=58).

Bidirectional orientations account for the second largest categories as general bidirectional is 24,1% (n=28) and bidirectional convergent is 15,5% (n=18) of the sub-sample. Total bidirectional dorsal orientation accounts for 39,6% (n=46). The other orientations account for negligible amounts of the sub-sample, however it is important to note the appearance of bipolar technology here as it is also found among the cores (Table 13).

Table 15. Dorsal scar patterns that indicate reduction in the SBLS.

Dorsal Scar Pattern	Number (n)	%
Bidirectional	28	24,1
Bidirectional Convergent	18	15,5
Bipolar	3	2,6
Indeterminate	5	4,3
Multidirectional	4	3,4
Unidirectional (With lateral cortex)	1	0,9
Unidirectional (with distal cortex)	1	0,9
Unidirectional Convergent	21	18,1
Unidirectional Parallel	35	30,2
Grand Total	116	100,0

Table 16 records the cortex coverage found on complete flakes removed from cores in the SBLS. Cortex is absent from the vast majority of the pieces (65%, n=206), while the second biggest category is <25% (18,7%, n=59).

Table 16. Cortex coverage on the blanks analysed in the SBLS.

Cortex coverage (%)	Number of lithics (n)	%
Absent	206	65,2
<25	59	18,7
25-50	23	7,3

Table 16 (continued). Cortex coverage		
50-75	17	5,4
>75	8	2,5
100	3	0,9
Total	316	100,0

4.4.3 Geometric Profile and Cross-section

Table 17 sets out the data on the geometric profiles and cross-section of complete and almost complete blanks in the 2020 SBLS assemblage. The geometric profiles of the SBLS blanks are dominated by curved (n=101, 40,4%) and straight (n=99, 39,6%) profiles. The characteristic twisted category makes up 17,6% (n=44) of the sample. The largest category in the cross-section analysis was indeterminate with 36,8% (n=92). The next two notable categories were triangular (n=40, 16%) and triangular asymmetrical (n=52, 20,8%).

Table 17. Geometric profile and cross-section analysis in the SBLS.

Geometrical profile and cross-section	**Curved (n)**	**%**	**Indeterminate (n)**	**%**	**Straight (n)**	**%**	**Twisted (n)**	**%**	**Profile (n)**	**Profile (%)**
Flat	9	3,6	0	0,0	23	9,2	2	0,8	34	13,6
Indeterminate	44	17,6	6	2,4	33	13,2	9	3,6	92	36,8
Trapezoid	4	1,6	0	0,0	7	2,8	8	3,2	19	7,6
Trapezoid (asymmetrical)	7	2,8	0	0,0	3	1,2	3	1,2	13	5,2
Triangular	18	7,2	0	0,0	12	4,8	10	4,0	40	16,0
Triangular (asymmetrical)	19	7,6	0	0,0	21	8,4	12	4,8	52	20,8
Grand Total	**101**	**40,4**	**6**	**2,4**	**99**	**39,6**	**44**	**17,6**	**250**	**100,0**

4.4.4 ‘End’ products and blanks

‘End products’ included here consist of blades, bladelets, flakes, and points. Blanks consist of the core management flakes as they are viewed to not have a specific or intended morphology as these kind of flakes are understood to be preparatory flakes which are removed in the process of manufacturing ‘end products’. All these lithics discussed here are complete or almost complete pieces (>20mm, apart from bladelets) which would provide measurements for length, width and thickness (Table 18).

Both points and blades vary widely in size in the SBLS. Points have a range of 70,1mm and blades have a range of 88,6mm. This is supported by the standard deviation values for length of points and blades which are both above 40, which seems to indicate little standardisation in size with many values deviating from the mean.

The mean length of studied cobble cores discussed above is 57,8mm. The largest blank lengths of the blades (109,9mm), flakes (86,3mm), points (90,7mm), and core management pieces (80,2mm) exceed that of the cores. This makes all blank types (apart from bladelets) substantially larger than the current core assemblage that has been assessed in the SBLS.

Based on the coefficient of variation, the biggest variation from the mean measurement in the sizes is seen in blades and flakes. Flakes have the largest variation in sizes; however, this category does largely contain any complete or almost complete flake that cannot be classified within the other categories. With regards to blades, the widths of these flakes do vary widely in thickness and length. Similarly, the thickness of core management flakes also varies more widely (nearly 60%) which seems to indicate less homogeneity in the thickness of these flakes and possibly little standardisation in refreshing the active surface of the core. Points have less variation from the mean size than most of the other groups. Finally, bladelets have the smallest variation throughout all three measures which seems to point to significant standardisation in size for bladelet removals.

Table 18. Metric attributes of complete and almost complete lithics per blank category.

Blank Category	**Number (n)**	**Maximum Length (mm)**	**Minimum Length (mm)**	**Mean length (mm)**	**Length SD**	**CV**	**Maximum Width (mm)**	**Minimum Width (mm)**	**Mean Width (mm)**	**Width SD**	**CV**	**Maximum Thickness (mm)**	**Minimum Thickness (mm)**	**Mean Thickness (mm)**	**Thickness SD**	**CV**
Blade	60	109,9	21,3	52,7	21,2	40,2	40,4	9,7	20,2	6,0	29,9	19,2	2,2	8,0	3,6	45,0

Table 18 (continued). Metric attributes of complete and almost complete lithics per blank category.

Bladelet	9	33,3	23,6	26,9	3,4	12,5	13,5	5,2	9,7	1,3	13,5	8,8	1,9	4,9	1,3	26,9
Flake	214	86,3	11,8	35,7	17,0	47,7	58,5	10,8	26,8	10,9	40,6	21,3	2,4	7,7	4,0	51,9
Point	31	90,7	20,6	51,0	20,9	41,0	45,1	12,7	26,8	9,3	34,7	15,0	3,6	7,7	2,6	34,3
Core Management	147	80,2	29,8	32,2	12,5	38,8	74,9	9,0	31,2	10,6	34,0	34,8	1,9	8,5	4,5	52,9

Following the variation measurements above indicating that there may be standardisation within the bladelet sample, the blades and bladelets were compared through their lengths and widths (only on complete blanks) to determine if a relationship exists between the lengths and widths. Several blades and a bladelet are found in Figure 4.9 below.

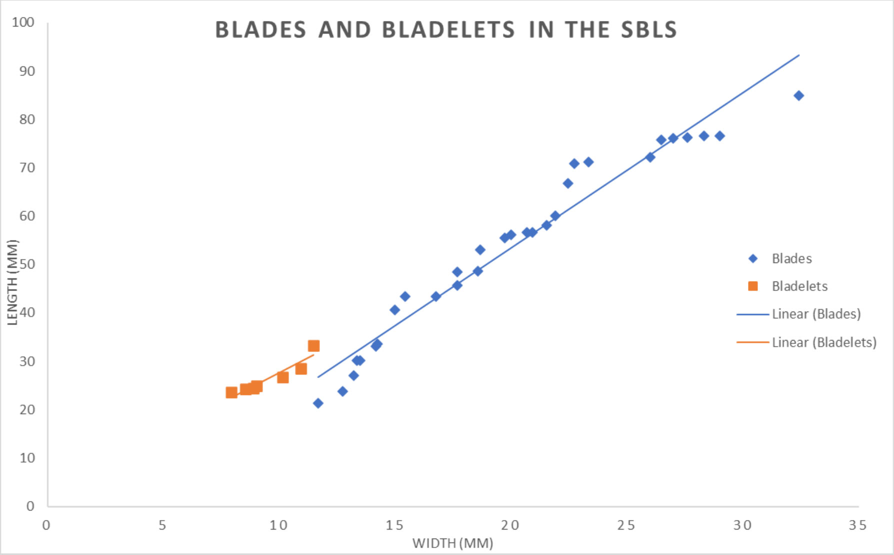


Figure 4.7 Blade and bladelet lengths and widths in the SBLS.

It seems largely directly proportional with widths increasing as the blades become more elongated. Although bladelets follow the same trend, they do not follow the same trendline as blades as they are proportionally longer from the outset (Figure 4.7).

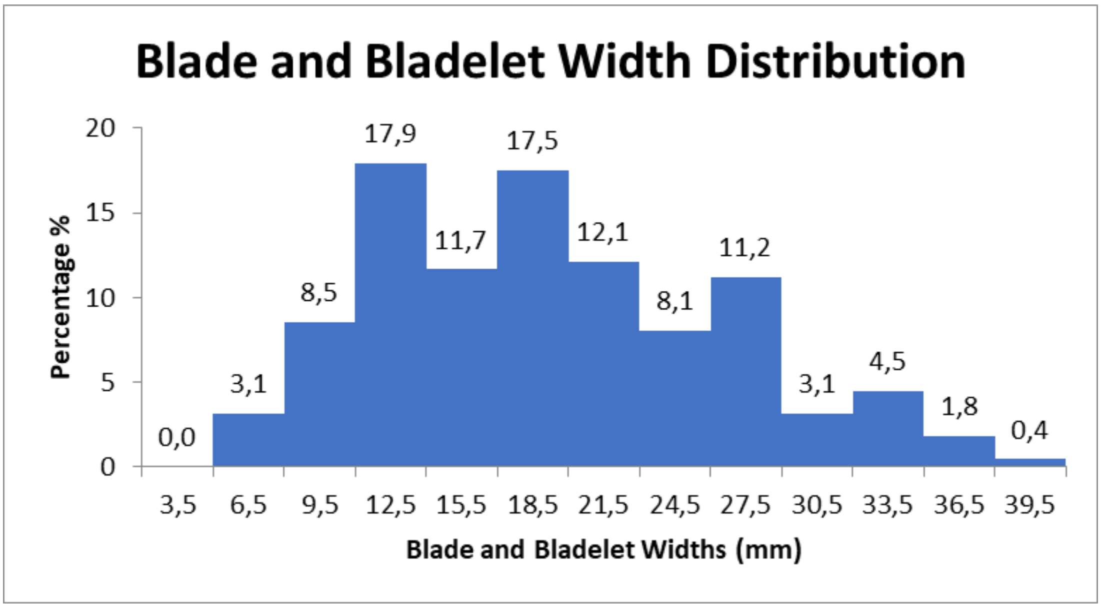


Figure 4.8 The distribution of blade and bladelet widths within the SBLS. The values above the columns denote the exact percentage of each bin range.

Figure 4.8 indicates that the blades and bladelets of the SBLS are bimodal, therefore containing a single mode in the distribution. The distribution is also positively skewed based on the sample's mean (19,2mm), median (18,5mm) and mode (13,2mm). If mean > median > mode, the distribution is regarded as positively skewed which means that the sample is dominated by width measurements that are smaller (in this case, meaning thinner) side of the distribution. In terms of a positive distribution, the 11,2% of values that fall between 26 and 29mm can be regarded as an outlier.

Figure 4.9. Several blades and a bladelet from the SBLS. The lateral views show the curving and twisting of blank profiles that are also found in the SBLS.

4.5 Retouch, utilisation and discard

4.5.1 Tools

There is a sub-sample of 202 possible tools (22,6% of total blanks >20mm, and 3,1% of the total sample including <20mm), 72 (35,6%) present some level of retouch, 103 (51,0%) present what may be edge damage on the margins of the flakes, and 27 (13,4%) seem to possess both retouch and edge damage. The largest tool categories (Table 19) identified in the sample were edge damaged blanks (50,5%). These are blanks that did not fit into other categories due to possessing no retouch and their morphology not immediately attributing them to another tool type. However, these blanks seem to have informal retouch in the form of general edge damage which could be created through anthropogenic action. This is followed by blanks that have been categorised as only possessing a single retouched notch (nearly 26,1%) and flakes with two retouched notches (10,4%). The other categories only account for 7% of the sample each, however these tool types, although very low in number may provide insight into past behaviours. For example, borers, burins and scrapers may have had specific uses. Examples of both retouched and edge damage notching are provided in Figure 4.10 below.

Table 19. Tool types, retouch and edge damage with the SBLS.

Tool, retouch, edge damage	Retouch (n)	%	Edge Damage (n)	%	Both (n)	%	Total (n)	%
Borer	0	0,0	1	0,5	0	0,0	1	0,5
Burin	2	1,0	0	0,0	0	0,0	2	1,0
Denticulate	1	0,5	0	0,0	2	1,0	3	1,5
Edge Damaged	0	0,0	102	50,5	0	0,0	102	50,5
Multiple Retouched Notches	10	5,0	0	0,0	3	1,5	13	6,5
Single Retouched Notch	37	18,2	0	0,0	16	7,9	53	26,1
Two Retouched Notches	17	8,4	0	0,0	4	2,0	21	10,4
Scraper	5	2,5	0	0,0	2	1,0	7	3,5
Grand Total	72	35,6	103	51,0	27	13,4	202	100,0

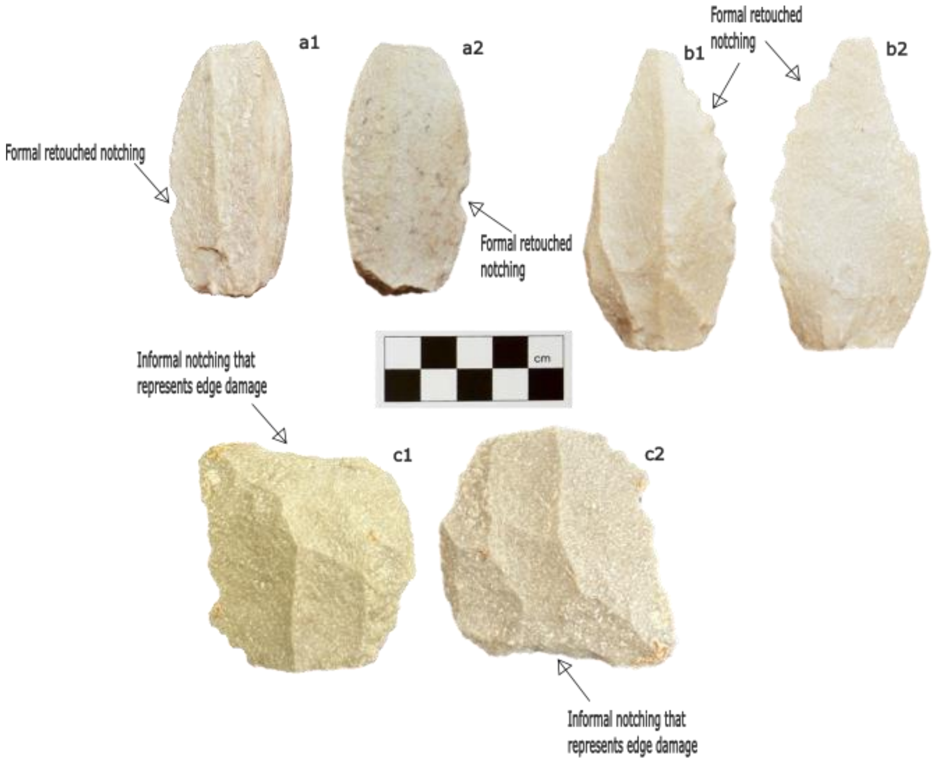


Figure 4.10. Formal and informal notching present in the SBLS. (a) and (b) represent the formal notches created through the actions of intentional retouch. (a1) and (b1) display the notches from the dorsal surface, and (a2) and (b2) from the ventral. Retouch can be initiated from either surface, therefore in (a) you can see the notch on the ventral surface and in (b) you can see the multiple notches in the dorsal surface. (c1) and (c2) represent informal notching that has been classed as edge damage. A similar 'half-circle' morphology is seen on these notches; however, they are not as invasive as retouched notches, are less standard in their shape, and are only noticeable from the surface on which they initiate (unlike retouch which can be seen from both surfaces).

4.5.2 Tip Cross-sectional Area Analysis

The sub-sample of lithic points (n=35, 81% of points) complete enough to undergo TCSA analysis were measured following the formula. Table 20 sets out the intervals each point falls within. It should be noted that the TCSA size intervals do overlap, which allows for points to fall under more than one category and thus provides for an inflated total of 46 in Table 20. It is shown in Table 20 that the largest category for the points analysed is stabbing spear tips (30%, N=14), followed by arrowheads (nearly 19,6%, N=9), an additional category between stabbing and thrusting spears (17,4%, n=8), and then both dart and javelin tips (15,2%, N=7 respectively). Nothing fell with the smallest category of poisoned arrow tips and only a single outlying point fell within the biggest category of thrusting spear tips (representing nearly 3%). This additional category was created simply to account for points with values that outside of the other intervals in the updated TCSA range set out by Lombard *et al.* (2022b).

Table 20. Tip Cross-sectional Area measurements placed within the relevant size intervals.

Weapon type	**TCSA range** (after Lombard & Churchill 2022 & Lombard *et al.* 2022)	**Number of lithics n**	**%**
Poisoned arrow tips	4-18	0	0,0
Arrowheads	17-47	9	19,6
Dart tips	40-76	7	15,2
Javelin tips	42-90	7	15,2
Stabbing spear tips	80-200	14	30,4
Between Stabbing and Thrusting spear tips	201-252	8	17,4
Thrusting spear tips	253-785	1	2,2
Total		**46**	100,0%

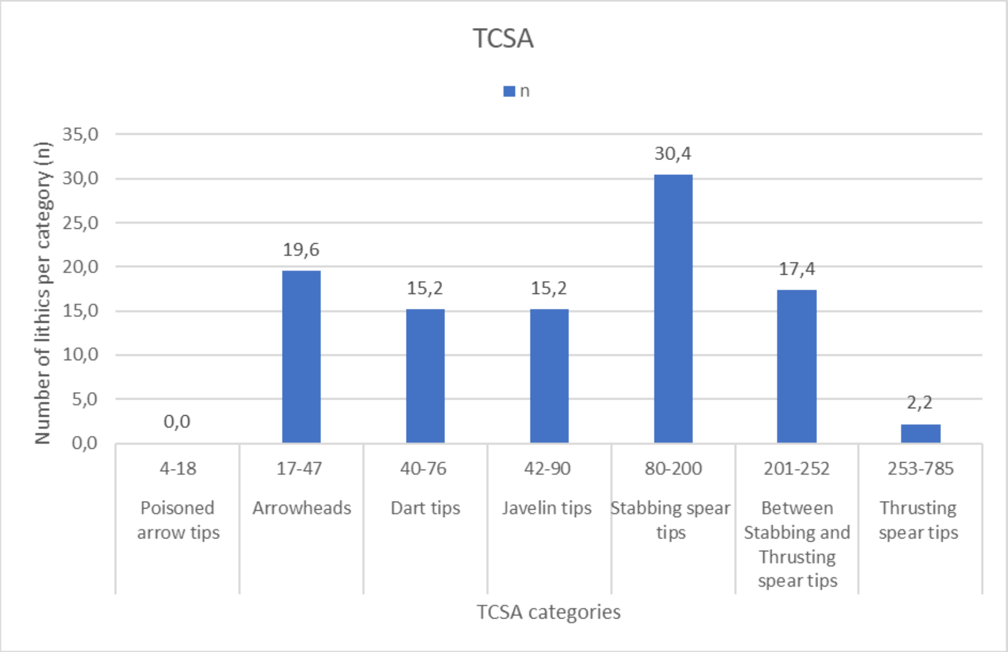


Figure 4.11. Tip Cross-sectional Area values (values above bars are percent per category in the sample). The bars represent number of points per category (n), while the value above each bar represents the percentage each category makes up of the total 100% of the sample.

Figure 4.11 illustrates the TCSA values within their categories. Apart from the majority of the TCSA points falling with the stabbing spear category, three other categories here are close together. This seems to indicate a split in the sub-sample between potential stabbing weaponry alongside as least some form of distance weaponry considering these three categories (arrowheads, dart tips and javelin tips) significantly outweigh the stabbing spears (n=23).

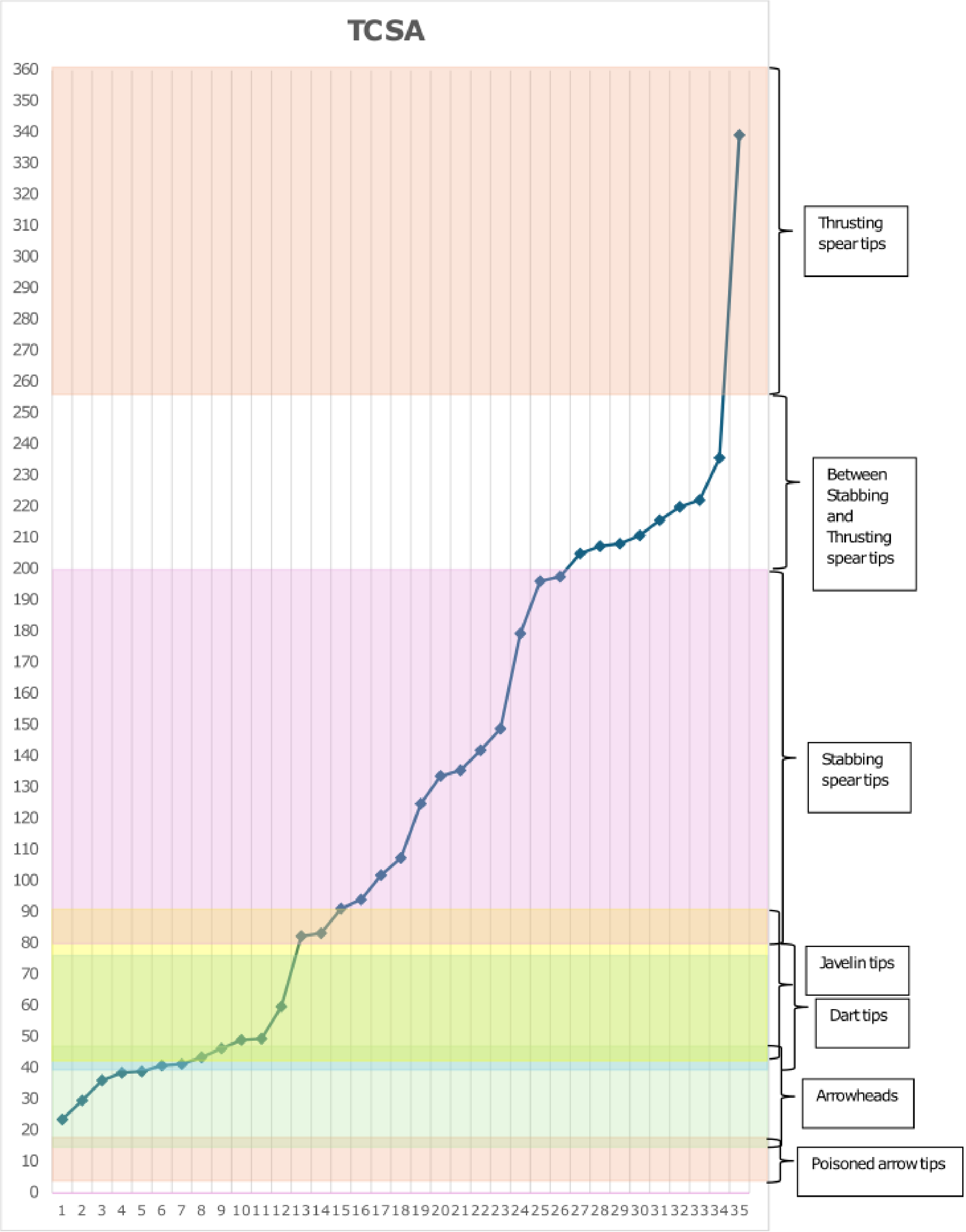


Figure 4.12. Tip Cross-sectional Area values.

Figure 4.12 illustrates the spread of the TCSA values within the points sub-sample. Again, the number of lithics in the TCSA sub-sample is 35, therefore the plot in Figure 4.10 records the value of each point. This value differs from Table 19 as there three points fall within two intervals. Apart from the single thrusting spear tip sized point which seems to be an outlier, the figure seems to indicate that the other values that fall within the other well represented categories (arrowheads, dart tips, javelin tips and stabbing spear tips) group together in those categories and have similar values. This may indicate a tendency or pattern for these specifically sized points. Below, Figure 4.13 represents several points that have been analysed from the SBLS layer. Most notably the curved profile of points is clear on nearly all the lithics (see Appendix C for further pictures of SBLS points).

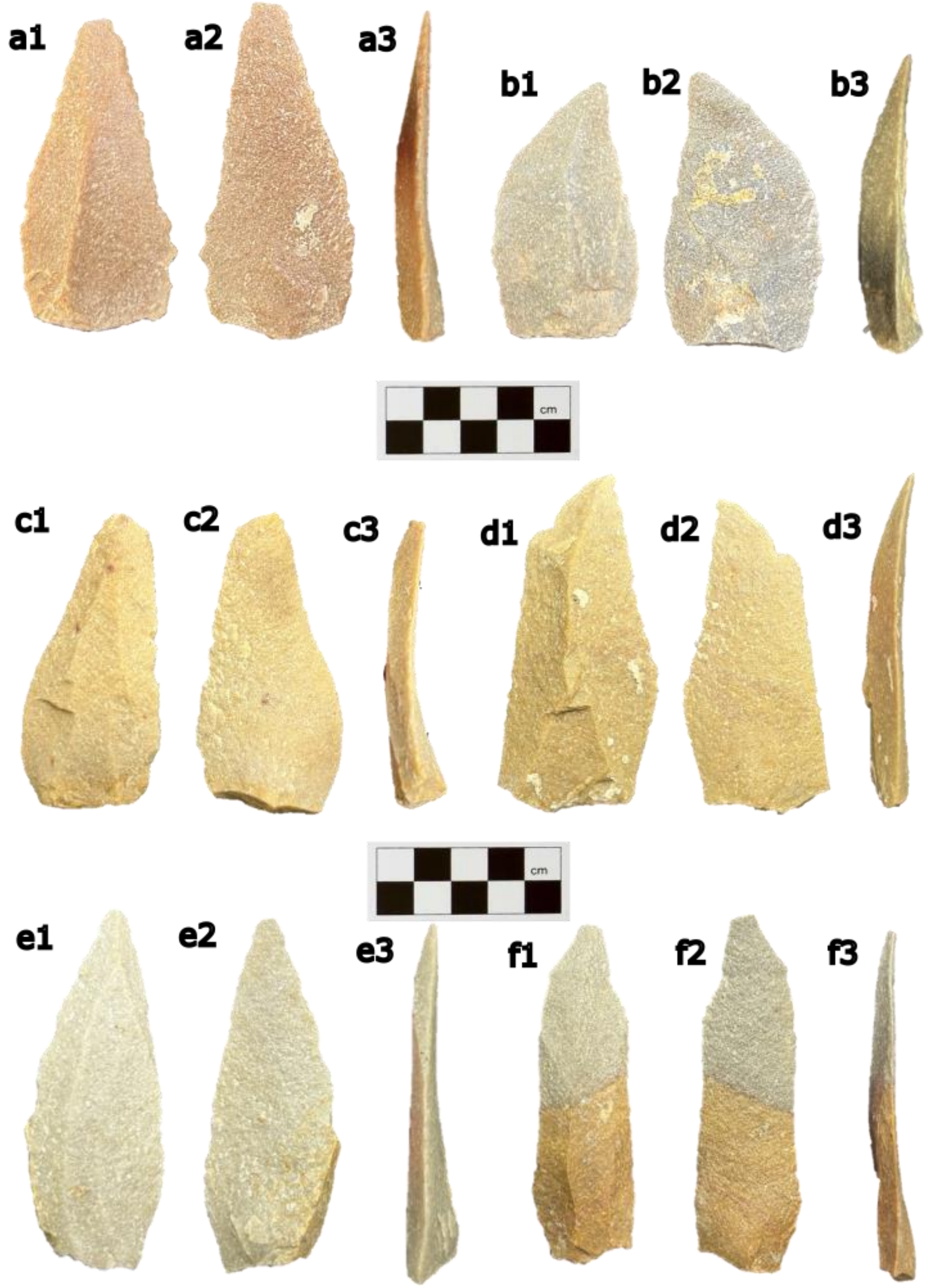


Figure 4.13 Several points from the SBLS. This indicates both the variation amongst the points as well as the curved profile which dominates in the SBLS. (1) is the dorsal surface, (2) is the ventral surface, and (3) is the side/lateral profile.

4.5.3 Macro-Fractures on points

The macro-fractures (Table 21) on the points to better understand their possible uses. This analysis was carried out on the lithic points subsample of 45 points. The number of points here is higher than in the TCSA analysis as fractures can still be assessed on incomplete points that do not meet the measurement requirements of TCSA analysis. These macro-fractures are the same fractures that have been analysed in the fragmentation sub-section below (sub-section 4.6.1). It is possible that macro-fractures on the points may not be due to utilisation, however the purpose of this analysis is to bolster the hypothetical inferences (such as TCSA) that it is possible that the SBLS points did possibly undergo use as hunting implements. Most fractures recognised were snap fractures at 27,7% (n=13), with no other category making up more than 12% of the sub-sample. Step (10,6%; n=5) and spinoff (10,6%; n=5) fractures are the other macro-fracture categories which are also well represented considering only 61,7% (n=29) of this sub-sample possess fractures. Two lithics possessed two fractures, therefore the sub-sample has been recorded on 47 lithics. Of these 47, these macro-fractures were recorded on the distal tip of the point on 25 of the lithics, whereas the other 2 lithics had the macro-fractures on the distal lateral margins so these are included in the final count.

Table 21. Macro-fractures identified on the lithic point sub-sample.

Macro-Fracture	Number of points (n)	Percentage of sub-sample (%)
Snapped	13	27,7
Hinged	3	6,4
Stepped	5	10,6
Spin-off	5	10,6
Impact burination	1	2,1
Feather terminating fracture	2	4,3
No fracture	18	38,3
Total	**47**	**100,0**

4.6 Post depositional attributes

Post-depositional attributes such as fragmentation and encrustation, as well as the dimensions and weights (described above), were recorded on the plotted and unplotted material >20mms. These are discussed here as these attributes do not fit within the *chaîne opératoire's* breakdown.

4.6.1 Fragmentation

No particular fragmentation category (Table 22) has an outright majority in the SBLS assemblage as the highest proportion is 23,27% (N=185) of the sample being complete lithics. It is important to note that 40,88% (N=325) of the sample is either complete or almost complete lithics which allows for analysis of all the relevant *Chaîne Opératoire* attributes that cannot necessarily be assessed on fragmented pieces.

Table 22. Relevant fractures found in the SBLS sample.

Fracture	**Lithic fragmentation (N=795)**	**Percentage (%)**
Almost complete	140	17,6
Complete	185	23,3
Distal	67	8,4
Indeterminate	7	0,9
Lateral	22	2,8
Medial	92	11,6
Medial-Distal	34	4,3
Proximal	146	18,4
Proximal-Medial	85	10,7
Split Flake	17	2,1
Grand Total	**795**	**100,0**

4.6.2 Encrustation

Encrustation was recorded on 793 plotted and unplotted lithics, encompassing 89% of the sample of lithics >20 mm (Table 23). Encrustation was recorded in relation to the extent of coverage of the lithics' surface. Category 1, which denotes simple 'spotting' on the lithic surface accounts for over 68% (N=543) of the assemblage. This seems to indicate that more extensive encrustation or surface covering is limited within the SBLS lithic sample. Less than 28% (N=220) of the sample accounts for category 2, indicating coverage of less than 50% of the lithic surface. It would seem the more extensive coverage of category 3 and 4 could possibly be outliers as these categories carry small percentages.

Table 23. Encrustation present on the SBLS lithics.

Encrustation categories	**Number of lithics possessing encrustation (N)**	**Percentage (%)**
1 (spotting)	543	68,5
2 (<50%)	220	27,7
3 (50-90%)	27	3,4
4 (entirely covered)	3	0,4
Grand Total	**793**	**100,0**

4.7 Conclusion

Based on the description of the results, it is clear that certain attributes are better represented within the SBLS sample than others which is unfortunately a problem faced by such studies due to the material that is analysed and its preservation. However, the above results of the technological and morphometric attributes of the SBLS have allowed for various inferences to be made on the behaviours of the KRM humans at the time. All these attributes described above fit neatly within one of the steps of the *Chaîne Opératoire* approach and, therefore, the wide array of attributes that have been analysed through this study could be used to describe the SBLS in terms of its technological characteristics and this is discussed in Chapter 5.

CHAPTER 5 DISCUSSION

5.1 Introduction

Following the analysis of the technology and possible indicators of utilisation this chapter discusses how the results set out in Chapter 4 may assist in assessing the aims and testing the research hypothesis of this study. The research hypothesis is that *Homo sapiens* employed different lithic production, utilisation, and hunting behaviour during the SBLS occupation compared to the overlying SMONE and BOS layers. This has required thorough comparison with the analysis of the SMONE and BOS One and Two (discussed together as BOS) layers by Brenner (2019) and Brenner and Wurz (2019), and the work of Oberholzer (2021) on the BOS Three. A wider comparison to the MSA I/Klasies River and the broader MIS 5 lithic technology is included. The TCSA results were compared with Lombard's (2021a) preliminary results on the hypothetical delivery systems in the SBLS. The objectives included the technological analysis of the SBLS lithics (i.e., the *chaîne opératoire*), the TCSA analysis of the points from this layer as well as the macro-fracture analysis of the point blanks to infer use of the material. The sub-section 'technology in the SBLS' (5.2) sets out the discussion on the attributes that underpin the *Chaîne Opératoire* of the SBLS as well as unpacks the comparison of these attributes with the overlying layers (SMONE and BOS One, Two, & Three). Appendix B sets out the extended comparison between the SBLS and overlying layers.

5.2 Technology in the SBLS

5.2.1 Raw material

Raw material procurement in the SBLS has displayed a preference for the use of quartzite (both fine to medium-grained and coarse-grained). This indicates that all lithics in the SBLS confirm previous studies on the raw material composition of the MSA I/Klasies River KRM assemblages to favour quartzite over other, potentially 'foreign', minerals. However, the number of the minor raw material types (hornfels, quarts and silcrete) is somewhat higher in the SBLS as opposed to previous studies on the MSA I/Klasies River at KRM (Wurz 2000; Wurz 2002) with 3% in the SBLS and 2% reported for previous studies.

At the heart of raw material procurement within the *Chaîne Opératoire* is understanding the decision making that surrounds procuring local and 'non-local' raw materials to produce lithics. It is understood that although there are rare instances of ESA hominins sourcing 'non-local' materials, MSA groups seemed to display a wider spread ability to source both local and non-local material (Blegen 2017). Therefore, by the SBLS occupation period these behavioural choices would have been well established. A study carried out on material from Hollow Rock Shelter for example discusses that raw material selection for the MIS 5 assemblage was a conscious choice for MSA humans (Högberg & Lombard 2022). It seems likely that knappers in the MSA did not simply knap whichever material was immediately available, but rather chose to.

Several theories have been proposed on how to assess whether a raw material is adjudged to be local or non-local. Two approaches have been applied by O'Driscoll and Mackay (2023) to describe the gathering range at which a material becomes regarded as non-local to the site. The approaches simply differ on the distance at which the material is regarded as non-local. The first approach views a material as non-local if it is gathered more than 10 km from the site at which the lithics are manufactured (Rios-Garaizar 2016; Will 2021). The second approach views non-local material as anything procured more than 20 km from the manufacturing site (Porraz *et al.* 2013). Neither approach seems to be more correct than the other, therefore both can be used to infer local versus non-local material choices.

Table 24. Raw material procurement in different regional settings compared with the SBLS and KRM.

Raw Material Procurement				
SBLS	**KRM (SMONE & BOS 1-3)**	**Southern Cape Sites**	**East Coastal Sites**	**Interior Sites**
Dominated by the local procurement of quartzite	Dominated by the local procurement of quartzite	Either 100% locally derived material (BBC) or a hybrid between local and exotic which local dominates (PP13B)	Locally derived hornfels and quartzite materials (UB)	100% locally derived materials (GHN and BRS)

As made clear by Table 24 (as well as Table 26 in Appendix C) the younger SMONE and the three BOS layers share the same approach to raw material procurement. It is only the BOS Three which has a small minority of potentially non-local materials as only the quartzite is described as local (Oberholzer 2021). All these layers represent occupations that followed the strategy of largely procuring locally available material. In the case of KRM this is quartzite. Within the wider MIS 5 in South Africa the exploitation of local raw materials is a feature that is believed to characterise the lithic manufacturing of the period (Douze *et al.* 2015; Mackay

2016). However, patterns both similar to and differing from the SBLS are observed. The MSA I of Elands Bay Cave (EBC) (Schmid *et al.* 2016), the assemblage from Ga-Mohana North rock shelter (GHN) (Schoville *et al.* 2023), Umbeli Belli (UB) shelter in Kwa-Zulu Natal, the M3 phase at BBC (Douze *et al.* 2015), C1-4 and CU assemblage from Cape St Blaize (Thompson & Marean 2008), and the Pietersburg of Bushman Rock Shelter (BRS) (Porraz *et al.* 2018) all display signs of raw material procurement strategies that focused on the gathering of 100% local materials for lithic manufacturing. Alternatively, several sites exhibit what can be viewed as strategy which sees the inclusion of both local and non-local material in the assemblages. The assemblage drawn from the GGLBS layer at Klipfonteinrand 1 (KFR1) is made up of locally occurring quartzite as well as non-local materials such as hornfels or decaying white sandstone (DWS) that are available at least ±17km from the site (O'Driscoll & Mackay 2023). Similarly, Pinnacle Point Cave 13B (PP13B) also provides assemblages from MIS 5c and d that are a mixture of local and non-local procurement (Thompson *et al.* 2010). However, it should be noted that even within these 'hybrid' procurement strategies, the assemblages are dominated by locally derived materials. Therefore, non-local material makes up a small minority, which is what is seen in the SBLS.

It would seem that on the whole raw material procurement in the MIS 5 followed explicit strategies to prioritise the collection and use of locally derived materials (as seen in Table 24). This is seen at a variety of sites that span several biomes from the southern and western Cape coasts to the interior of South Africa. The SBLS assemblage now supports this notion, and with the context of the *Chaîne Opératoire* displays the first conscious step that SBLS humans (and their other MIS 5 counterparts) undertook to produce and reproduce this distinct cultural actions or signatures over space and time.

5.2.2 Technique of flake removal

As described in Chapter 3, section 3.3.2, platform characteristics, platform types, and bulbs of percussion have been used to infer decision making on the technique used for the removal of blanks from the core during the *debitage* process. Specifically, the appearance of these attributes indicate the use of direct percussion to remove blanks. This may be either hard or soft hammer percussion, with the former using a mineral hammer and the latter using a biological (wood or bone) or soft mineral (soft sandstone) hammer (Inizan *et al.* 1999; Roussel *et al.* 2009). Certain attributes have been argued to evince a particular kind of percussion (Wurz 2000; Brenner & Wurz 2019; Oberholzer 2021). Thicker platforms, 90° external platform angles, and prominent bulbs are viewed as evidence for hard hammer percussion, while weak (diffused) bulbs, lipping, external angles more obtuse than 90º and platform preparation are evidence of soft hammer percussion (Inizan *et al.* 1999; Wurz 2000, 2002).

All the abovementioned attributes appear within the SBLS in significant amounts which may indicate that more than one percussor was used. For example, the prevalence of hard hammer direct percussion is supported by the dominance of plain or unplanned faceting orientations on platforms of all blanks apart from points, 90º exterior platform angles, and prominent bulbs, as well as negative bulbs since a hard hammer direct force may break the bulb as opposed to simply just forming a prominent bulb. A similarly large and significant portion of the assemblage (44%) possesses weak bulbs, many of which possess platform preparation, and although informally registered and requiring further analysis, lipping is not entirely absent from the blanks. The length and width characteristics of the platforms in the SBLS also seem to indicate a tendency for somewhat smaller platforms based on the distribution of platform sizes in the assemblage and also possesses sizes similar to the MSA I sample analysed by Wurz (2002) which were viewed as 'small' platforms. Although more clarity on whether this represents an anomaly or not may be required, such small platform sizes, in combination with the weak bulbs and lipping, point to soft hammer percussion. This is in line with an overview of the MSA I by Schmid *et al.* (2016) and the MSA I D-sample studied by Wurz (2000) that both soft and hard hammer percussion is present in the technology of MSA I. Schmid *et al.* (2016) cite that 30% of previously studied MSA I assemblages exhibit features that are viewed as evidence for soft hammer percussion.

Due to the co-existence of attributes representing both soft and hard hammer techniques (for example, prominent bulbs, facetted platforms and varied external platform angles), it has been argued that proximal attributes (i.e. bulbs, preparation, and platform angle and type) may not be perfectly exact in determining the removal technique. This has been voiced previously by several authors regarding the efficacy of these attributes to determine a hammer type and technique, as well as the bulb of percussion specifically where it is argued that the relative prominence of the bulb may be an entirely random factor and should not be considered a discriminating characteristic when trying to determine the hammer type used (Bordes 1948; Wenban-Smith 1999; Roussel *et al.* 2009).

The inferred use of hard or soft hammer percussive techniques have previously been argued to be significant technological variations (Wurz 2002; Porraz *et al.* 2013), however experimental work has indicated that this may not be as clear cut as it has been argued in previous research (Magnani *et al.* 2014). This statement regarding the accuracy of percussion analysis raises a second point. In some cases, some studies on lithics avoid explicitly inferring a percussive technique. This may be due to the variability of attributes and the difficulties associated with the relevant analysis. Criticism has been levelled against attribute analysis in the past where, most notably, the analysis of attributes on lithics has been treated as *a priori* (Shott 1994). That is to say, that the accurate analysis of an attribute such as the bulb of percussion and what can be inferred is treated as being derived from sound theoretical deduction and not observation which may be more subjective. The appearance of particular attributes are then viewed as clear indicators of particular behaviour without additional analysis or interpretation (Shott 1994). In the same vein as Högberg (2016), to avoid this pitfall an attempt has been made here to only infer a technique type if several attributes can be analysed together that may indicate that technique.

The same attempt to avoid the pitfall has been made in the other studies at KRM, therefore these overlying layers can be compared with the SBLS on the basis of percussive technique. In BOS Three, the characteristic for blades, bladelets, and flakes were viewed as evidence of hard hammer percussion, although this usually means that prominent bulbs would be present. However, points differed from this and possibly present evidence that BOS Three points required a different removal technique as the majority of the studied points possessed 'visible' bulbs (which largely line up with the weak or diffused bulbs studied here in this study), platform preparation and facetted platforms (Oberholzer 2021). A similar difference is seen in the SBLS as the majority of the points either have facetted or plain platforms (which in itself indicates a possible difference in behaviour between BOS Three and SBLS humans) and 70% of the points possess some form of platform preparation. This may indicate that another percussor technique was used, similar to the BOS Three. However, the major bulb present on SBLS points is a prominent bulb which again contradicts the notion that these blanks were removed by a soft hammer. Perhaps the subjectivity of the bulb designations requires more clarity.

SMONE and BOS (One & Two) blanks are argued to have been manufactured using hard hammer percussion due to the presence of prominent bulbs and have an external platform angle close to 90º (Brenner 2019; Brenner & Wurz 2019). Therefore, it would seem that hard hammer percussion is prominent throughout the MIS 5 period at KRM.

This technique is replicated in other parts of MIS 5 southern Africa, while other approaches are followed elsewhere. The MIS 5 Pietersburg assemblage from Bed 5 at the Cave of Hearths (CoH) (Limpopo, South Africa) has been argued to have been manufactured using a hard hammer technique (Oberholzer 2021). Similarly, the MIS 5 material analysed from BRS as well as the MSA-Mike (or type 'Mike') assemblage from Diepkloof Rock Shelter (DRS) have had a hard hammer technique of flake removal inferred (Porraz *et al.* 2013; Douze *et al.* 2020). To the contrary, as with the SBLS, the MIS 5 also saw the use of hard hammer percussion alongside other percussive techniques, such as a soft hammer. This has been seen in the wider MSA I (as at EBC) where hard hammer percussion is seen alongside bipolar-on-anvil percussion (Schmid *et al.* 2016). Elsewhere in the southern Cape MIS 5, the Still Bay bifacial lithics from BBC were manufactured using an inferred strategy of both hard and soft hammer percussion to shape the core and remove products (Villa *et al.* 2009), although the Still Bay appears towards the end of MIS 5 specifically.

However, another approach to avoiding the pitfall described by Högberg (2016) would be to look beyond the assessment of an inferred percussive technique and rather stick to a more conservative approach of comparing the attributes of the SBLS themselves with the wider MIS 5 assemblages where the hammer technique is not clear. The GGLBS assemblage at KFR1 is dominated by a majority of plain platforms where other more prepared orientations are limited. It should also by noted that 'marked bulbs' (prominent bulbs) make up a minor portion of the assemblage and platform preparation has not been identified in the assemblage (O'Driscoll & Mackay 2023). At an attribute level, it would seem that the same platform preparation and blank removal actions may have been used in the SBLS and the GGLBS considering the tendency to utilise the same platform orientations in the bulk of removals. The difference in the presence of prominent bulbs remains unclear considering the subjectivity in this attribute's analysis.

At PP13B, the assemblage presents a dominance of plain and facetted platforms alongside a notable portion of dihedral platforms (Thompson *et al.* 2010). Again, *Levallois* and non-*Levallois* products were analysed separately and provide different views of platform orientation. The non-*Levallois* blanks, which are similar in technology to the SBLS, possess two equally dominant platform orientations in facetted and plain. In the *Levallois* material, the overwhelming majority of platforms are facetted (Thompson *et al.* 2010). Based solely on attribute comparison it seems different behaviours were exhibited at PP13B as opposed to KRM. At Cape St Blaize, the MIS 5 layers provide similar evidence to KRM where the dominant orientations for platforms are plain and facetted, however it is important to note that the potential behaviours based on the attribute differ as the frequency of facetted platforms are on the whole higher than plain platforms (Thompson & Marean 2008). As with PP13B, the analysis of the platform attribute at Cape St Blaize indicates potentially differing actions in lithic manufacture in the past as opposed to KRM.

Platform preparation on MSA points is believed to be an established feature (Schoville *et al.* 2023). It is present in significant numbers at KRM, particularly on points (as discussed above), and in comparison, the MIS 5 lithics of PP13B and Cape St Blaize also possess platform preparation. Interestingly, the preparation is fairly equal across blanks which is different from KRM. Similarly, throughout the MIS 5, platform preparation at PP13B is more frequent (and increases through time) than seen at KRM from the SBLS to SMONE. It should be noted that although preparation is an established feature and it is evidently present in the southern Cape, in the interior a different pattern is seen. At CoH, the Pietersburg assemblage has minor preparation with less than 20% of all blank types possessing any preparation (Oberholzer 2021). This indicates that preparation as an attribute itself indicates differing behaviours throughout the MIS 5 as the form of the attribute varies widely.

Whether or not the technique of removal is explicitly put forward or the focus remains on solely comparing the attributes, the comparisons between the SBLS, other KRM assemblages and the wider MIS 5 of southern Africa remains possible. When taking the approach of explicitly describing the percussive technique employed in the SBLS, it has been possible to infer that both soft and hard hammer percussion were employed. Further to this, it becomes clear how this supports earlier claims on the MSA I as well as similarities and differences through time between KRM assemblages. The second approach to attribute analysis has indicated that specific attributes can be compared and provide insight into the variation in techniques throughout the MIS 5. Irrespective of which approach is employed in the analysis of attributes through the *Chaîne Opératoire* it is clear that conscious decisions were made by MSA humans throughout southern Africa and during the SBLS at KRM specifically. The recurrence of particular forms of the abovementioned attributes in differing frequencies indicate the creation and recreation of socially specific decisions throughout the MIS 5 which inform the wider approaches to how humans removed their blanks from cores in the past.

5.2.3 Method of Reduction

The attributes of both blanks and cores have provided data from which information on the possible method used to reduce cores has been inferred. In the SBLS the majority of the cores come from cobble blanks of varying granularity. The SBLS is dominated by parallel reduction alongside a minor presence of bipolar and multidirectional technology. In terms of removal orientation, the core sample indicates a dominance of bidirectional reduction alongside unidirectional reduction. The bipolar core indicates that the SBLS also saw the reduction of cores and a technique of flake removal which is similar to the MSA I of EBC that has evidence of the same technology (Schmid *et al.* 2016).

With regards to technological category, the most abundant category in the SBLS is core management pieces, which is over half of the sample when *débordant* material is included. It would seem that the majority of flakes removed in the SBLS are preparational and that significant reduction of the core takes place. Unidirectional orientations are more dominant than bidirectional orientations however, bidirectional orientations are still substantial. This is the converse to the interpretation made on the cores and indicates that, sample biases aside, both orientations were important and deliberate strategies to reduce the cores of the SBLS. Multidirectional dorsal orientation and bipolar technology is limited in the SBLS; however, it is nonetheless present and, alongside the more dominate orientations, indicate a varied approach to reduction.

In comparison with the younger Witness Baulk layers excavated by Oberholzer (2021) and Brenner and Wurz (2019) it can be seen that platform, *Levallois*, and informal cores make up the bulk of the BOS Three sample (Table 24, Appendix C). Informal cores are described by Andrefsky (2008: 144) as having undergone no preparation, where usable pieces were detached from the core opportunistically. This would then include rotated multidirectional cores and all cores that are viewed as having a 'non-formalised' shape (Andrefsky 2008: 158 & 237). Flakes with multidirectional orientation are present in the BOS Three which may support this informal opportunistic reduction. However, multidirectional reduction of the core does fit certain conceptions of *Levallois* reduction as the convexity of the active surface can be managed from several directions (Andrefsky 2008). Therefore, it is not entirely clear whether the multidirectional orientations seen in the SBLS indicate opportunistic reduction or the more formal managing of core convexities. The *Levallois* cores from BOS Three can be categorised along with the parallel cores (Conard *et al.* 2004) as seen in the SBLS. Therefore, it would seem that to a lesser extent the BOS Three and SBLS share some similarities regarding reduction method based on cores, where the key difference is the use of platform cores. In terms of dorsal scar orientation, BOS Three is dominated by unidirectional orientations, followed by bidirectional orientations. The points in the assemblage follow the same trend as the SBLS where most points are unidirectional, and thus represent possible similarities in behaviour.

The SMONE and BOS One & Two core samples both consist of platform and unidirectional parallel cores, however there is a minor presence of bidirectional cores in BOS One & Two (Table 24, Appendix C). In SMONE, overall unidirectional orientation dominates the assemblage, followed by a small bidirectional portion (16,7%). Similarly, BOS is dominated by unidirectional orientations with almost a quarter of the cores representing bidirectional removals (23,3%) slightly more than SMONE. This dominance alongside the core data has seen both these assemblage being described as having a unidirectional parallel reduction system (Brenner & Wurz 2019). This is also the likely strategy for the BOS Three which has similar ratios in orientation categories. Therefore, it would seem that the SBLS may, to some extent, fall into the same reduction strategy as there is a substantial amount of unidirectional, parallel technology. However, the appearance of both bidirectional blanks and cores does indicate that a second reduction strategy was undertaken and maintained alongside unidirectional parallel reduction as the bidirectional portion of the assemblage is far greater in ratio than in the overlying layers.

The broader MIS 5 has provided some interesting insights into reduction strategies used throughout southern Africa. The Cape coast MIS 5 is dominated by unidirectional parallel systems. This can be seen at PP13B where several assemblage follow this system and provide parallel and platform cores to manufacture largely quartzite lithics (Thompson *et al.* 2010). On the eastern coast of South Africa at Sibhudu Cave (previously spelt Sibudu (Bader *et al.* 2022b)), unidirectional orientations similarly dominate the assemblage and the vast majority of lithics are made from dolerite (Schmid *et al.* 2019). On the other hand, Cape St Blaize followed a differing strategy that used radial, blade and point cores on largely quartzite material (Thompson & Marean 2008) and the M3 phased at BBC used both unidirectional parallel and centripetal parallel systems to manufacture an assemblage from mostly silcrete and quartzite (Douze *et al.* 2015). The interior of the southern African MIS 5 provides interesting approaches to reduction systems which share some similarities and differences with the SBLS or the coastal sites. Holley Shelter of the KZN interior is dominated by unidirectional reduction on platform cores, with lithics made from dolerite, quartzite, quartz and hornfels (Bader *et al.* 2015). The

Bed 5 assemblage at CoH utilises a reduction strategy that has evidence of both informal and formal core reduction. The informal reduction is argued to perhaps be a sign of extensive reduction sequences as the core was continually reduced opportunistically as long as useful blanks could be removed. The formal reduction relied most heavily on *Levallois* cores and platform cores on a range materials from quartzite to smaller proportions of quartz, hornfels and chert (Oberholzer 2021). Pietersburg assemblages in the interior at Mwulu's Cave (MC) (de la Peña *et al.* 2019) and BRS (Douze *et al.* 2020) also provide evidence for *Levallois* reduction strategies made from varied amounts of quartz, quartzite, chert, and hornfels (depending on the site). Unifacial points similar to the Bed 5 assemblage have been identified at MC and BRS as well (de la Peña *et al.* 2019). The GGBLS at KFR1 follows a three-way reduction strategy represented by discoidal, *Levallois*, and laminar cores (O'Driscoll & Mackay 2023). The inclusion of raw materials here is simply to illustrate that, although similar and differing materials have been used at a variety of sites in South Africa, the there does not seem to be a clear indicator that the inferred choice around reduction are linked to the materials used.

Returning to the MSA I of EBC, similar features such as uni- and bidirectional reduction, including the reduction of elongated flakes unidirectionally, is present alongside orthogonal reduction strategies (Schmid *et al.* 2016). This was done both on single as well as multiple planes on cores of quartzite slabs. Where the single plane or active surface is the same as the SBLS, the multiplanar approach is different. This may be due to differing core blanks that allowed for this difference in reduction decision making, although it seems that the SBLS does share some further commonalities with the wider MSA I. With regard to the broader MIS 5, it would seem that there is substantial variability across time and space where differing strategies are used in differing combinations to reduce cores. The SBLS supports this view as, although it finds similarities with other MSA I and coastal assemblage reduction strategies, it possesses differences which infer that the humans at the time made decisions different from other groups that have not been mimicked elsewhere.

Blank cross-sections and profiles have also been used to infer patterns in decision-making. Although cross-sections of blanks may provide some pointers in terms of the intended shapes of a flake that knappers in the past may have planned to remove, the category has limited utility in this study as many pieces were indeterminate. However, the largest category after indeterminate were blanks with a triangular cross-section, which is something that is shared with the BOS Three. This seemingly indicates a similarity in terms of the shape of blanks that were removed. Blank profiles were somewhat more helpful in inferring decisions taken on platform reduction in the past. Curved profiles (which includes twisted profiles) dominate the SBLS assemblage (58%, Table 24, Appendix C) which seems to indicate a preference to work cores that have a convex active surface. From the outset, this supports the SBLS presenting technology in line with the MSA I/Klasies River at KRM as these previously studied assemblages possess considerable evidence for curved and twisted blanks (Wurz 2002). A minority portion of the SBLS assemblage (40%, Table 24, Appendix C) possesses straight profiles and, therefore, suggests a changing reduction strategy from removing blanks from a convex active surface until the active surface straightened out allowing for removals with straight profiles. The overlying layers are dominated by straight profiles and therefore present the opposite of the SBLS and possibly point toward a reduction technique that relied less on removing blanks from a convex surface but rather focused on relatively straight removals from the core.

Within the wider MIS 5, the GGLBS at KRF1 is dominated by curved profiles as in SBLS (O'Driscoll & Mackay 2023). Similarly, the D-A layers at Sibhudu Cave is made up of a majority of curved profiles, however in cross-section these assemblages are dominated by trapezoidal orientations (Schmid *et al.* 2019). This indicates that curved blanks and the intentional removal of curved volumes is an attribute that is widespread in space and time. These curved profiles are a shared feature of the SBLS, GGLBS, and D-A layers and interestingly all three of these assemblages have been manufactured of cobble cores. This seems to point towards rounded cobbles as the raw material package having some effect on blank profiles. However, the overlying layers at KRM do not possess the same tendency towards curved profiles and the raw material packages on these layers are also dominated by the same quartzite beach cobbles as the SBLS. Therefore, it is not immediately obvious how raw material package affects blank profiles. The appearance of differing cross-sectional orientations illustrates that cross-section and profile are mutually exclusive. Conversely, straight profiles are also widespread in the MIS 5 as seen in the overlying layers at KRM. The Pietersburg at CoH (Oberholzer 2021) and at BRS (Porraz *et al.* 2018) is dominated by straight profiles, although triangular cross-sections have been recorded as the dominant orientation at CoH (Oberholzer 2021). This simply indicates again that differing combinations of profile and cross-section exist together in the MIS 5 and the dominance of straight profiles at some sites indicates that the particular profile seen in the SBLS at KRM is a distinct strategy for core reduction.

The metric attributes of the 'end products' have provided interesting data. The mean lengths of cobble cores are significantly smaller than the measurements for the largest blanks in the assemblage. The larger blanks may point towards a great degree of reduction of the cores. In the SMONE and BOS, a similar trend is seen compared to the SBLS where the blanks are considerably longer than the available cores (Brenner & Wurz 2019). The same view is held by Brenner and Wurz (2019) that this may indicate longer, more extensive reduction sequences of the cores in these overlying layers as is seen in the SBLS. Regarding BOS Three the values for maximum blank lengths are clustered close together in their distribution (Table 24, Appendix C, also see Oberholzer (2021)) and these similarities are not present in the SBLS. Therefore, the blank lengths in the SBLS are not as consistent as the blank sizes in the BOS Three. On the whole, SBLS blanks are shorter than BOS Three.

The appearance of both blades and bladelets can allow for their comparison between layers at KRM. The blades and bladelets of SMONE and BOS are shown to have a bimodal distribution which may be a sign of different reduction strategies between the blank types (Brenner & Wurz 2019). This differs from the SBLS as the blades and bladelets in this assemblage seem to be unimodal (Figure 4.5), however it is not clear whether this immediately means that a similar reduction strategy was used to create both blanks. A similar distribution is not provided for the BOS Three, however the mean, standard deviation and coefficient of variation can be compared (explained in Appendix B). The BOS Three bladelets are generally narrower than the SBLS, and the SBLS bladelets are more homogenous in width. With regard to blades, BOS Three possesses less homogeneity amongst blade widths than the SBLS. This does provide some insight into morphometric differences between layers, although this cannot assess the difference in reduction sequence.

These data from KRM, encompassing part of the coastal MIS 5, can be discussed alongside assemblages from the interior of southern Africa to assist with understanding the wider MIS 5. The Bed 5 Pietersburg assemblage at KRM has blanks that are on average longer than the SBLS and the Coefficient of Variation values indicate a more homogenous assemblage than the SBLS as well (Oberholzer 2021). Similar to the SMONE, BOS and SBLS, the Bed 5 assemblage also indicates extensive reduction based on the lengths on blanks and the lengths of cores. Interestingly, the laminar products of the Pietersburg at BRS are on average smaller than the average of most blank types in the SBLS and there is significant morphological variability in the assemblage (Porraz *et al.* 2018). The cores of the MSA I at EBC are on average just shorter in length than the cobble cores of the SBLS, while the laminar blanks are on average similar lengths to the blades and points of the SBLS (Schmid *et al.* 2016). The blank and core lengths of the MSA I at EBC seem to indicate extensive reduction sequences as values mimic those of the SMONE, BOS and SBLS.

Finally, the cortex data could only be compared with overlying layers at KRM. Cortex cover in the SBLS (34,8%) occurs more often than in the SMONE (28,4%), but less so than BOS (38,7%). Cortex on cores could be compared between the BOS Three and SBLS where they have similar numbers of cores that present some level of cortex. 48,9% of BOS Three cores possessed some level of cortex, which is similar to the 54,5% of the SBLS (six of the eleven cores in the sample). These similar values seem to indicate that reduction was fairly extensive as most pieces are only struck from the core once the cortex of the active surface has been removed. The SMONE and BOS are regarded as extensively reduced based partly on this (Brenner & Wurz 2019), therefore the same should be said for the SBLS.

Therefore, it would seem that extensive reduction sequences are a feature of both coastal and interior occupations in the MIS 5 and are a shared concept in all these manufacturing strategies. Homogeneity in blank size is variable within the MIS 5 and there is no clear pattern. It does not seem clear whether or not these differences indicate specific choices in reduction sequences taken by the past knappers. Although only at KRM, it would seem reduction intensity seems consistent across the layers.

5.2.4 Retouch, utilisation and discard

With regard to the total SBLS assemblage (including <20mm), formally retouched tools make up 1,5% of the assemblage while 1,6% of the assemblage represents unintentional, informal notching which has been referred to as 'edge damage'. Within the >20mm sample in the assemblage, both categories make up about 11% respectively (Table 26, Appendix B). This seems to indicate that the retouch or reworking of tools in the SBLS is relatively limited as half of the possible tools were used without formal retouching. However, it must be noted that the preliminary work by Brenner *et al.* (2022) can be updated as formal tools do form part of the SBLS assemblage. This rare level of retouch, as in the SBLS, is common throughout the MSA (Schoville *et al.* 2023). MIS 5 in southern Africa seems to support this view as several other assemblages report similar results.

When compared with the overlying BOS Three, it seems there are stark differences in the levels of retouch and edge damage. Retouching was only present on a miniscule 2% of the analysed blanks and edge damage was recognised on an even smaller scale in BOS Three (Table 26, Appendix B). Denticulated pieces are viewed as the most numerous tool type in the BOS Three. In the SBLS, edge damaged pieces are the most abundant, followed by retouched pieces with only one or two notches. These two categories would likely compare to the 'notched' pieces discussed by Oberholzer (2021). Therefore, it seems that the SBLS relied on a markedly different retouch strategy compared to the BOS Three.

Similar to BOS Three, the SMONE and BOS (One & Two) do not provide many formal tools. Formal tools make up less than one percent of the SMONE assemblage (0,7% of all *debitage* >20mm) and less than three percent of the BOS assemblage (of all *debitage* >20mm). This is, again, significant as it is much smaller than the SBLS (Table 26, Appendix B). However, the SMONE and BOS have notably more edge damaged pieces, where this is most significant in BOS as the edge damaged pieces are nearly double. It would seem, between these layers, that there is less reliance on formal tools in the overlying layers than seen in the SBLS.

Regarding utilisation, the SBLS possesses several distinct tool types that have been tied to usage. These are borers, burins, points, and scrapers. It is not clear how notched and denticulated tools relate to a specific function. The overlying layers possess scrapers, notched tools and denticulated tools similar to the types in the SBLS (BOS Three: 2,2%, BOS:2,3%, SMONE 0,7%, Table 26, Appendix B). Within the wider MIS 5 several tools similar to the SBLS are present. At BBC, tools are also rare and are present in similar numbers (2,3%, (Douze *et al.* 2015)) to KRM. The M3 phase at BBC possesses notched and denticulated tools alongside scrapers, burins, and borers (Douze *et al.* 2015). PP13B follows BBC and KRM in the rarity of formal tools in the various assemblages that have been analysed, however, 'burin-like' retouched pieces, denticulated pieces, notched pieces, and backed pieces have been identified (Thompson *et al.* 2010). Somewhat differently, tools (12% in sample >20mm) increase at Cape St Blaize (Thompson & Marean 2008) where they appear in similar volumes to the SBLS. The only site with relatively more tools than Cape St Blaize and the SBLS are at Ysterfontein 1 (Groups 1-13) where 19% of the assemblage is identified as tools (Wurz 2012), although this assemblage does seem anomalous. This pattern seems to indicate that tools are a rarity across time and space in the southern Cape MIS 5. In the interior of southern Africa, a similar pattern seems to be present. At CoH, the Bed 5 assemblage has more tools than are present in the coastal assemblages (6,3%, (Oberholzer 2021)), apart from the SBLS, however, it still equates to less than 10%. About half of the tools in Bed 5 are regarded as tools based solely on the presence of edge damage, a similar figure to the SBLS sample. Similarly, the GGLBS assemblage at KFR1 presents a percentage (2,0%) of retouched (including notched and denticulated) pieces that fits the pattern seen elsewhere in the interior and on the coast (O'Driscoll & Mackay 2023). Finally, the MSA I assemblage described at EBC also presents a very small sample of tools (0,7%), dominated by notched pieces and scrapers (Schmid *et al.* 2016), which also provides an interesting point that the SBLS shares this similarity with other MSA I assemblages. It would seem that the same tool types are fairly widespread in space and time throughout the MIS. However, what is broadly evident is that the low number of tools in an assemblage is a common occurrence in MIS 5 and this is either a widespread marker for choices made by MIS 5 humans, or it is a vague pattern that carries little value for inferring distinct behavioural markers. One theory that has been put forward is that the low frequencies of retouched tools in MIS 5 assemblages indicate that humans at the time may have devoted more effort to managing blank morphology to create their tools rather than modifying the blanks after they were removed from the core (Schmid *et al.* 2016).

Discussions surrounding tools in the MSA are largely based on formal tools as is discussed above, however, the utilisation of lithic implements must include those tools that may provide insight into the more mundane, daily tasks of hunter gatherers. Ethnographic studies have greatly contributed to our understanding of everyday tasks carried out by humans both now and in the past. A notable example of this is the work done with the Ova Tjimba and Western Desert Australian Aborigines (Hayden 2015). Although this study was carried out with the express intent to apply contemporary behaviours to actions by ESA hominins using Oldowan and Acheulean tools, these everyday behaviours can be reasonably assumed to exist in the MSA.

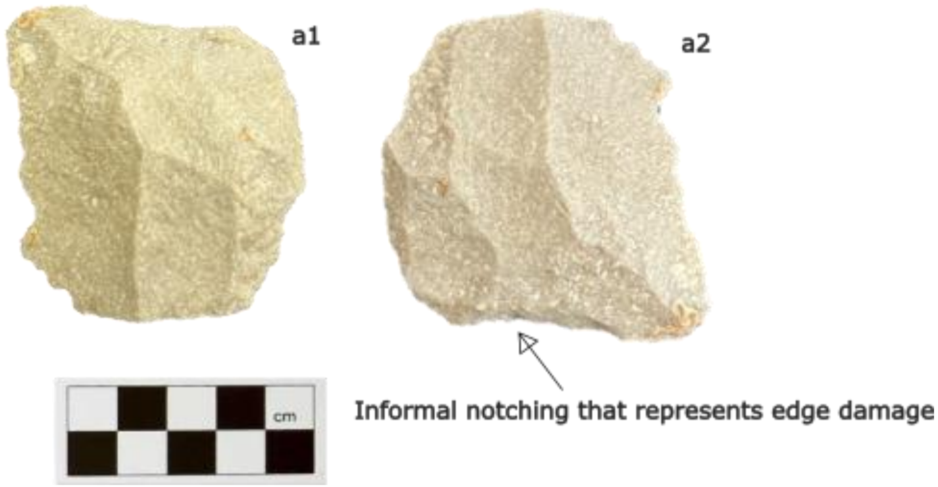


Figure 5.1. (a1) and (a2) represent the same flake from different orientations. This flake is a large unretouched flake similar to those described by Hayden (2015). The arrow pointing to (a2) indicates the distal edge of the flake which seems to present informal retouch in the form of edge damage.

The most notable behaviour which can be discussed from this ethnographic work is the manufacturing of wooden spears, or spear shafts. By the time of the SBLS occupation hafting was a well-established behaviour (Wadley 2013; 2015), therefore the manufacturing of spear shafts can be reasonably assumed. Ethnographically, the Ova Tjimba and Western Desert Australian Aborigines would regularise tree sapling into shafts using flakes to remove any existing asperities from the sapling. Several types of flakes have been employed in the shaft working, namely, thick unretouched flakes and notch or denticulate type retouched flakes. This wood working is particularly important for weapons such as javelins, therefore these inferred behaviours may have been important in the SBLS when considering the possible importance of javelins (discussed further in 5.2.6.). The SBLS, like many MSA MIS 5 assemblages, sees the presence of retouched tools with limited notching or denticulation, as well as many unretouched flakes that exhibit macroscopic edge damage (as seen in Figure 5.1). Therefore, a possible use for some of these, particularly more informal, tools may have been daily tasks such as wood working. Finally, Ova Tjimba groups have used bipolar reduction strategies to manufacture the flakes used in butchery behaviours (Hayden 2015). Bipolar reduction is present in the SBLS; however, it is not clear at this stage whether similar inferences to these observations can be made. Therefore, it is important to note that similar signatures that have been seen ethnographically are present in the SBLS and further study in this regard should centre on microscopic use-wear studies to expand on these inferences.

The discarding of tools within an assemblage has largely been viewed as a behavioural strategy that is inferred from the usage of local or non-local materials and the level of retouch present in the assemblage (Thompson *et al.* 2010). The assemblages of KRM have all been viewed as representing an ‘expedient’ strategy which entails the use of local raw materials and, due to the explicit focus on readily and easily available raw materials, significant reuse of tools is not required as new tools could be easily manufactured. Therefore, the amount of retouch is limited. This seems to be the apparent strategy employed by SBLS humans as the raw materials in this assemblage are argued to be locally sourced and retouch is limited to 11% of the blanks in relation to lithics >20mm, a relatively low percentage. This retouch itself is also by and large limited to one or two notches per tool, which is therefore also not extensive working of the tools. The same strategies are argued to have been employed in the SMONE and BOS (One & Two) (Brenner & Wurz 2019). This expedient strategy has also been explicitly identified at PP13B (Thompson *et al.* 2010) where material usage and retouch are similar to KRM. Many of the studies that have been used to discuss the broader trends in the MIS 5 do not explicitly discuss a discard strategy similar to the approach employed in this study (and others). Therefore, considering that these other MIS 5 sites and assemblages present similar evidence for raw material utilisation and retouch intensity, it could be argued that at least to some degree a similar expedient strategy may have been implemented. It is then perhaps possible that a more expedient approach to utilisation and discarding of lithics was a behavioural trait at both KRM during the SBLS as well as the wider MIS 5.

Finally, the macro-fracture and TCSA analyses of the SBLS points are discussed below. The points are believed to have been used as hunting implements based on the evidence provided by the following attributes (following Lombard 2021a; Lombard *et al.* 2022b; Lombard & Churchill 2022).

5.2.5 Macro-fracture analysis

As discussed in chapter 2, macro-fractures alone cannot allow researchers to infer utilisation. Therefore, the hope in this study was to identify the likelihood that at least some of the points in the current SBLS sample underwent longitudinal impact which could indicate the possibility of hunting behaviours. This is due to the macro-fractures present on the points having been created through the action of active hunting. The majority of points in the SBLS possess fractures (62%). As shown in Chapter 4, Table 20, a wide range of fractures were identified (Fischer *et al.* 1984; Lombard *et al.* 2004; Lombard 2005a; Pargeter 2011, 2013). Diagnostic impact fractures (DIFs) which could result from longitudinal impact caused by the propelling of a hunting implement towards a target was identified on 62% (n=29) of the points. Therefore, the fractures present in this sample are used to simply support the notion that these points could have been used in hunting behaviours. This supports the TCSA analysis discussed below, although additional use-wear analyses in the future could help bolster this.

5.2.6 Tip cross-sectional area analysis

In the SBLS layer, points in the stabbing spear category are the most numerous (30,4%) as shown in Chapter 4, Table 20, with the smaller categories of arrowheads (19,6%), dart tips (15,2%), and javelin tips (15,2%) also being well represented. The appearance of a relatively large number of small points that could function as arrowheads is an interesting occurrence as the SBLS occurs much earlier than the believed advent of bow and arrow technology in the MSA of southern Africa. The possibility of arrowheads appearing earlier than the currently accepted period would require more intense research on hafting signatures and microscopic use-wear analysis to support this finding here. Therefore, this designation should perhaps be treated as a departure point for further studies at this stage.

Turning to the other categories, the appearance of dart or javelin tips firstly seems to indicate a diversity in delivery method of hunting implements. Close-range stabbing spears may have been used in tandem with ranged weaponry, as the sample is split in half with 50% of the sample indicating ranged weapons alongside 50% hand-delivered weapons. The single thrusting spear seems unlikely to be an explicit decision by humans to make a close-range implement that is more 'heavy duty' than a stabbing spear. This is because the appearance of a single lithic (2,2%) in this category does not make it statistically significant and should therefore perhaps be treated as a stabbing spear outlier or part of the points that fell in the additional category between stabbing and thrusting spears. It has more recently been argued that there is no ethnographic evidence for the use of spear-thrower and darts (i.e., dart tips) in Africa while there has been ample ethnographic evidence to support all other weapon delivery systems (Lombard & Churchill 2022), particularly with javelins that are argued to have been part of human arsenals 300ka (Sahle *et al.* 2023). Therefore, through an ethnographic lens, it may be best to accept that the use of javelins in the SBLS may be a more likely hypothesis. Weapon technology of the past has been viewed as being manufactured in such a way that it can respond to functional requirements and environmental pressures (Sahle *et al.* 2023). Therefore, the javelin finding is supported by the palaeo-environmental data which seem to indicate that the SBLS fell in a period of more open environments in the MSA southern Cape (Reynard & Wurz 2020) where ranged weaponry would have had greater/better utility. Therefore, the most likely hypothesis that could be proposed for the SBLS on the grounds of TCSA analysis would be an explicit strategy that included ranged weaponry alongside close-range stabbing weaponry to bring down prey.

The SBLS points studied here seem to echo Lombard's (2021a) preliminary results that point to the SBLS being markedly different from other MSA layers as well as largely tending towards the smaller end of the TCSA size spectrum. Compared with overlying layers, the SBLS points studied here and by Lombard (2021a) are by and large smaller in size. The box and whisker plot (see Lombard 2021a: 9) values show that up to the 3rd percentile (up to 75% of values) are smaller than the 1st percentile of the BOS Three ("lowest BOS", taken from Lombard (2021a)). A similar trend is seen with the SMONE where the upper 75% (1st percentile and above) of the sample would fall into the thrusting spear category. Although smaller points that fall into the arrowhead, dart, and javelin categories are present in the BOS and SMONE samples, it makes up a quarter or less of the sample, which is the opposite to what is seen in the SBLS. The spread of the point sizes in the SMONE and BOS is much greater than the SBLS, and the SBLS is the only dataset (both for this study and Lombard (2021a)) that is more heavily skewed towards the lower end of the size values. Therefore, this indicates a possible difference in the behavioural strategies of the SBLS humans to their later counterparts of the overlying layers. The hypothesis seems to be that the SBLS humans relied more heavily on ranged weaponry for their hunting behaviour, whereas the SMONE and BOS humans focused more on close-ranged hunting based on their possible implements. This may be simply due to differing environments of their time periods; however, it does seem to support this study's hypothesis that SBLS humans employed markedly different behaviours.

A broad pattern in terms of apparent weapon delivery systems exists in the MIS 5. From the MIS 5b – e, the general trend in southern Africa is that assemblages are dominated by points that can only be classed as thrusting spears and the smaller categories make up 30% or less of the assemblage. This trend is seen throughout southern Africa with assemblages from the southern Cape coast such as PP13B, PP5-6, the Mossel Bay of Cape St Blaize, and Klein Jongensfontein all providing points that mostly fit the thrusting spear size category. In the interior assemblages such as the Pietersburg from Olieboomspoort and CoH, as well as assemblages from other sites such as BRS also indicate a similar pattern. HRS in the Western Cape interior follows this pattern as well (Lombard 2021b). Therefore, this pattern is widespread through space and time in the MIS 5 and also spans several broader biomes.

Interestingly, the anomalous lithic sizes are not only unique to the SBLS. The Pre-Still Bay material studied at Sibhudu Cave, on the eastern coast of South Africa also tend to be smaller than other assemblages of the period (Lombard 2021b), however, this assemblage dates in ±77ka which is significantly later than the SBLS. Assemblages in the MIS 5 only begin to tend towards the sizes seen in the SBLS towards the end of the MIS 5 with the introduction of HP material. Therefore, it seems from a size perspective there are similarities between the SBLS points and the much later HP in southern Africa.

The distinct size difference between SBLS points and other broad contemporaneous material at least hypothetically indicates that a different hunting technique was followed at KRM at the time. It seems such wider spread use of smaller points only becomes evident in the HP at the end of the MIS 5, however, beyond point size further investigation is required into potential links between earlier material like the SBLS and the HP. Sahle *et al.* (2023) have discussed large variations present in javelins used in modern ethnographic contexts by hunters in Ethiopia as well as these variations potentially providing insight into the involvement of children in activities such as hunting both in the present day and in the past. The appearance of a broad distribution of javelin tip sizes has been shown to indicate the involvement of children as smaller tips are used by younger, less competent members of the group as they learn to hunt. At this stage it is not possible to assess the SBLS points in such a manner that may investigate this argument by Sahle *et al.* (2023). Therefore the next step regarding TCSA analysis and weapon delivery systems for the SBLS (and the wider MSA) should be the assessment of javelin variability and its impact on the past.

5.3 The inferred behaviours of the SBLS humans through the *Chaîne Opératoire*

This sub-section is used to summarise the above discussion within the bounds of the *Chaîne Opératoire* to infer the behaviours of the SBLS humans. It should be noted, again, that the attributes described and analysed through the *Chaîne Opératoire* approach may seem to point toward a possible techno-typology for a lithic assemblage, the approach does not mean that we are able to create cultural identities for groups in the past, for example the humans who manufactured and deposited the SBLS material. Therefore, the attributes that have underpinned the discussion on inferred behaviours above, which are summarised for the SBLS below, are not cultural markers of SBLS humans, but rather evidence for their intentional actions in the past when manufacturing their tools (Audouze 2002; Tostevin 2012). Whether these decisions were made through an etic or emic understanding of decision making is not clear, and we may never be able to assess this for human behaviour in the past, however the *Chaîne Opératoire* that underpins the inferred behaviours of the SBLS humans does allow for a greater understanding of the inferred and possible long term social and behavioural changes that took place at KRM in the MSA.

5.3.1 Raw material procurement

In the SBLS, the procurement of raw material followed a strategy that prioritised the collecting of locally available raw materials which are easily accessible and widely available at KRM. This is best exemplified by 96% of the sample being made from readily available quartzite, in the form of water-worn beach cobbles. The remaining raw material minority is made up of non-local materials.

5.3.2 Technique of flake removal

The blank removal technique in the SBLS points towards an emphasis on hard hammer direct percussion. This is supported by most of the blank platforms for blades, bladelets, and flakes in the SBLS being either plain or un-specifically facetted, having external platform angles that are more or less 90º, and possess either prominent or negative bulbs. The presence of characteristics that points towards soft hammer percussion also indicates that soft hammer percussion was also employed to a lesser degree. Although, the appearance of relatively small platforms does seem to be contrary to what is expected of hard hammer percussion and may require more clarity on whether these platform sizes are anomalous or not.

5.3.3 Method of reduction

The method of blank reduction in the SBLS is laminar with removals being either uni- or bidirectional parallel. This is supported by both the core sample and the dorsal scar patterns from which technological categories can be inferred. Anvil damage on one core also indicates a small tendency for bipolar reduction. The comparison of flake sizes to available cores also seems to indicate high levels of reduction in the SBLS.

5.3.4 Retouch, utilisation, and discard

The preliminary work by Brenner *et al.* (2022) can be updated as formal tools are present in the SBLS assemblage. Although formal tools are present, it seems that the retouch or reworking of blanks in the SBLS is largely limited as many pieces were used without retouching, and another third of the apparent tool sample only possess one or two notches. Therefore, apart from a handful of more extensively worked tools, retouch in the SBLS is limited. In terms of utilisation, the SBLS has provided burins, borers and scrapers that were likely used to carry out a variety of tasks. TCSA and macro-fracture analysis indicates that the points of the SBLS may have likely been used for hunting as evidence of longitudinal impact in the form of macro-fractures and the dimensions of the points supports such a possibility. An active hunting strategy that would rely on the use of both ranged weaponry in the form of javelins and close-range weaponry in the form of stabbing spears in a relatively open environment has been inferred from the available evidence. Finally, the humans of the SBLS seemingly followed an expedient strategy in the discarding of lithics, based on the readily available local raw materials and limited retouch within the assemblage.

5.4 Is the SBLS the same or different?

When comparing the SBLS with the directly overlying layers of BOS (One, Two, & Three) and SMONE, there seems to be ample evidence that although some similarities exist in the production sequence of the lithics the behaviours inferred between the layers are indeed markedly different. As unpacked above, there are similarities that range from the same local raw material procurement methods as all layers are largely made up of locally available quartzite from river or beach cobbles, while other materials are described as both local (silcrete) (Brenner & Wurz 2019) and non-local (hornfels). The SBLS differs somewhat from overlying layers with the flake removal technique indicating a primary use of hard hammer percussion alongside soft hammer percussion, based on platform characteristics such as exterior platform angle, bulb of percussion, and platform morphology. Further differences on the layers becomes apparent in the technology of the reduction methods.

The SBLS seemed to prioritise parallel reduction (as the entire sample fits into this system), while the overlying layers (at least in part) relied on platform or bladelet systems as well which represent entirely different decisions from the SBLS. Although the dorsal scar orientations indicate similar tendencies through the appearance of uni- and bidirectional scar patterns, the SBLS has a greater presence of bidirectional reduction than the overlying layers. In all layers, blank lengths exceed the size of available cores. Therefore, it seems long reduction sequences are possibly a hallmark of all these KRM layers, however, a difference between BOS Three and SBLS does exist as the blank lengths of BOS Three are more homogenous in measurement values than the SBLS. The curved and twisted profiles of the SBLS are in stark contrast to the overlying layers which are dominated by straight profiles which indicates different approaches to managing core convexities. Retouch remains limited in all layers, although the SBLS has significantly more blanks in its assemblage that possess retouch.

The key difference between the SBLS and the overlying layers comes in the form of inferred utilisation where, particularly, the TCSA values indicate that the SBLS possesses markedly smaller points which infers that the SBLS humans may have employed a hunting strategy different to the overlying layers that seemed to prioritise hunting through close range stabbing spears.

Although the SBLS can be viewed as markedly different to the overlying layers, how different it may be to the wider MIS 5 in southern Africa and the Broader MSA I/Klasies River industry is not as clear cut. In terms of raw material procurement, it is evident that the MIS 5 is characterised by procurement strategies that prioritise the use of locally available materials as non-local materials are only present in low numbers (if present at all). Flake removal technique throughout the MIS 5 varies considerably and the indication that the SBLS has evidence for both hard and soft hammer percussion is not unique. It should, however, be noted that these flake removal techniques indicates that the SBLS does follow other assemblages which have been attributed to the wider MSA I/Klasies River industry as other assemblages from KRM and EBC support the use of hard hammer percussion alongside a smaller tendency for soft hammer percussion.

The method of reduction in the SBLS seemingly finds similarities with both other reduction strategies on the Cape coast and the broader MSA I as the reduction strategy is dominated by unidirectional parallel working. However, again, the substantial variability that exists across time and space with regard to reduction strategies in the MIS 5 means it is difficult to ascribe them to the same technology, even when similar strategies are present at different sites. The SBLS supports this view as it does possess similarities with other MSA I/Klasies River assemblages as well as other coastal assemblages, however, there is also evidence of reduction strategies that differ from these assemblages making it partly different. The curved and twisted profiles of the SBLS are in line with the curved profiles found in other MSA I/Klasies River assemblages. However, on a regional scale cross-section and profile data cannot easily indicate that the SBLS is different from other MIS 5 assemblages. This is due to there being a broad variation in the combinations of blank cross-sections and profiles that dominate different assemblages. Therefore, this helps more with understanding decisions made by the manufacturer of a particular assemblage rather than providing a clear indicator of similarity or difference.

The SBLS differs markedly from both other MSA I/Klasies River and broader MIS 5 assemblages based on utilisation aspects of the *chaîne opératoire.* Although tools can still be seen as limited in the SBLS as with all MIS 5 assemblages, the percentage of tools is far greater than what is generally found both on the coast and in the interior for the period. Only the C1-4 and CU assemblage at Cape St Blaize have a similarly large tool sample. The second metric on which the SBLS markedly differs is in the TCSA analysis. In line with the similar findings by Lombard (2021b), the SBLS points are on the whole smaller than other assemblages and indicate a possible emphasis on javelin tip sized weapons alongside the bigger points that could be stabbing/thrusting spears (which is the general finding in the MIS 5). Generally, tip sizes only begin to reach the sizes seen in the SBLS more broadly with the appearance of HP industries. Therefore, it is evident that the manufacturing and possible use of these points indicates markedly different behaviour to both other MSA I/Klasies River assemblages and the broader MIS 5 in southern Africa.

Through the *Chaîne Opératoire* approach that has been used in this study, it is quite evident that the approach has utility in allowing researchers a platform from which the longer-term changes in social behaviour can be assessed. The SBLS *Chaîne Opératoire* represents the perceived intentionality of human actions in the past and has made it quite clear that the SBLS lithics and its inferred behaviours are markedly different to other periods in the MSA when looking at social and behavioural change as a long-term process. The presence of particular lithics or particular lithic attributes represent the production and reproduction of social behaviours that took place during the SBLS and that stand out from behaviours before and after this occupation.

CHAPTER 6 CONCLUSION

The lithics of the SBLS layer have provided significant data for understanding both the behaviours of humans during this occupation as well as the possibility of comparison with later, overlying periods and the broader MIS 5 which allows researchers to understand the change and development of human behaviours of the past over longer periods of time. The SBLS lithics, now seen to fit within the broader MSA I at KRM, have a long and detailed *Chaîne Opératoire* which sets out how raw materials, such as quartzite, can undergo change to become culturally specific artefacts. Through the *chaîne opératoire,* it is evident a specific amount of complexity was required to create the tools that were then utilised in a variety of ways. Raw materials, seen here as predominantly quartzite and to a minor degree as hornfels and silcrete, went through laminar uni- and bidirectional removals with both a direct hard and soft hammer used in conjunction to manufacture a variety of tools. Although these tools display limited retouch, they are more numerous than what is generally expected in the MIS 5 and indicate that a variety of tasks were carried out in the daily activities of hunter-gatherers, for example the working of wooden spear shafts. The tools of most interest in this study are undoubtedly the points which, hypothetically speaking, could have been used as hunting implements through a diverse strategy that would include the use of hand delivered weapons systems (thrusting/stabbing spears) that are a hallmark of the wider MIS 5 alongside the greatly emphasised ranged weapons systems (javelins and smaller). This has not been to say that javelins are a new phenomenon in the MIS 5 of southern Africa, but rather that during the SBLS occupation at KRM, past humans displayed behaviours unique to their context. In the end, all these attributes confidently point towards the likeliness that the SBLS *Homo sapiens* displayed markedly different behaviours from their counterparts that occupied KRM in the overlying layers.

Finally, this study has had several limitations which now provide several avenues for further research on the SBLS. The much-expanded SBLS sample in this study encompassed the 2020 excavation, therefore, the findings made here are only accurate to the part of the assemblage that has been analysed. Excavations have continued in the interim and the next step would be to analyse the material excavated in the 2022 and 2023 field seasons to either corroborate or modify the findings here. Regarding the research into utilisation behaviours, macro-fractures and the macro-analysis of tool margins have been a good departure point for the understanding of tools in the SBLS. The next step would be a more in-depth microscopic analysis of edge damage and retouch to understand the use-wear signatures and how this may assist in inferring behaviours. This would assist in supporting the macro-fracture result discussed in this study as it will help confirm whether the macro-fractures on the points are due to utilisation or other factors such as deposition. Finally, interesting points have been raised by Sahle *et al.* (2023) on the involvement of children and younger or less competent members of a group in hunting practices. The SBLS now has a much-expanded dataset of TCSA values and a better understanding of the possible weapons systems that may have been used. Therefore, the next step for TCSA analysis would be to explore this line of inquiry to determine if it may provide further inferences into the broad distribution of smaller point sizes in the SBLS.

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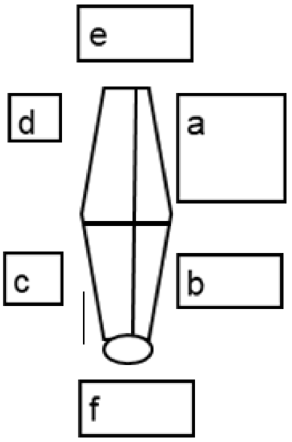
Appendix A: Breakdown of methodology employed, and attributes assessed.

Table 25. Summary of technological attributes that have been assessed.

Technological Attributes of Blanks	
Raw materials	Quartzite (coarse or fine-medium grained), quartz, Silcrete, Hornfels, Chert, shale, calcrete, mudstone, Indeterminate
Basic category	Blade, bladelet, flake, point, indeterminate, hammerstone, fragment, indeterminate
Fragmentation	Complete, almost complete, proximal portion, medial portion, distal portion
Technological category	Bidirectional (including convergent), unidirectional (including convergent), crossed, multidirectional, centripetal, débordant (including with lateral cortex), core management, platform shaping, indeterminate
Cortex type	Natural outcrop, cobble, raw material if crack present before flaking
Cortex percentage (%)	Absent, <25%, 25-50%, 50-75%, >75%, 100%
Platform type	Cortical, facetted (specific or unspecific), plain, broken platform, dihedral (specific or unspecific), "*en chapeau de gendarme",* winged, pecked, spur, linear, indeterminate
Platform preparation	Rubbed, trimmed, rubbed and trimmed, no preparation
External platform angle	Measured with a protractor to most accurate angle, then divided into intervals: 50-59 º, 60-69º, 70-79º, 80-89º, 90-99º, 100-110 º
Bulb of percussion	Prominent bulb, weakly developed bulb, negative bulb (*esquille bulbaire*), no bulb, indeterminate
Geometric profile	Straight, Curved, Twisted, Indeterminate
Geometric cross-section	Triangular (including asymmetrical), trapezoid (including asymmetrical), flat, indeterminate
Platform length, width, and thickness	Maximum length, width, and thickness measured in mm on platform margins at the proximal end, only on complete platforms
Length, width, and thickness	Maximum length, width, and thickness measured in mm, only on blanks with complete margins
Weight (g)	Weight measured in grams
Tool type	Single clactonian notch, multiple clactonian notches, single retouched notch, multiple retouched notches, denticulate, scraper, burin, borer, and edge damaged
Retouch/Edge damage type (Both attributes are measured on the same scale)	Very marginal, marginal, short to middle of blank, middle of blank to covering whole surface
Retouch/Edge damage positioon	Retouch/edge damage on ventral, retouch/edge damage on dorsal.

Retouch/Edge damage location	
Macro-fracture	Cone, bending (feahter, snapped, hinged, stepped, embryonic, spin-off), impact burination
Residue	Present, not present
Encrustation prevalence	Spotting, <50%, 50-90%, entirely convered
Encrustation location	Dorsal, ventral, platform, dorsal + ventral, dorsal + ventral + fracture, dorsal + ventral + platform, and dorsal + ventral + platform + fracture

APPENDIX B: COMPARISON BETWEEN SBLS AND THE OVERLYING LAYERS.

Appendix B compares the SBLS with the overlying layers at KRM. Table 25 sets out the similarities and differences based on the relevant attributes analysed. Green highlighted cells indicate similarities between the SBLS and one or more overlying layers for a particular attribute, while red indicates a clear difference for the data available for a specific attribute. Unhighlighted cells indicate that either no data is present or it is not clear whether the data indicate a similarity or difference.

Table 26. Comparison of the attributes analysed in this study against the SMONE and BOS One, Two, and Three (data taken from Brenner & Wurz (2019) and Oberholzer (2021).

Attribute	**SBLS**	**BOS Three**	**SMONE & BOS One/Two**
Raw material procurement			
Raw materials	Dominated by local procurement (96% quartzite).	Dominated by local procurement (94% quartzite).	Dominated by local procurement (SMONE 91%/BOS 80% quartzite).
Technique of flake removal			
Platform characteristics (median/mean width and length)	Recorded on all blanks >20mm Median: L= 16,3mm. W= 6,1mm. Mean: L= 17,1mm. W= 6,8mm.	Only mean values recorded. Flakes: L= 24,2mm. W= 9,8mm. Blades: L= 16,5mm. W= 8,4mm. Points : L= 27mm. W=13,1mm. Bladelets: L= 6,1mm. W= 2,1mm.	Only platform thickness recorded. **SMONE** Median: Blades: W= ±9mm Points: W= ±11mm Mean: Flake, W= 10,77mm Blade, W= 8,8mm Point, W= 8,2mm **BOS** Median: Blades: W= ±11mm Points: W= ±13mm Mean: Flake, W= 9,7mm Blade, W= 9,9mm Point, W= 11,8mm
Platform type	Dominance of plain and unspecific faceting. Minor tendency to facet some platforms. Facetted platform mostly present on points.	Blades, bladelets, and flakes present plain platforms, whereas points are dominated by facetted platforms.	Assemblage dominated by facetted and informally facetted (unspecific) platforms in all blank types.

Platform preparation	In the minority on blades, bladelets, and flakes. Where it is present it is generally trimming. 70% of points possess some form of preparation although trimmed is seen twice as much as rubbing. The appearance of both trimming and rubbing is negligible on all blanks. 13,3% of blanks possess rubbing and 24,7% are trimmed.	No preparation in the form of rubbing or trimming	Step flaking and trimming present on 33% (SMONE) and 39% (BOS 1&2) of the blanks. Rubbing uncommon as a preparation technique.
Bulb of percussion	No clear dominance, diffused bulbs the most numerous. However, significant numbers of prominent and negative bulbs present.	Dominated by weak bulbs.	Dominance of prominent bulbs in the assemblage.
External platform angle	Tendency to remove blanks around 90º (between 80-99º).	NO DATA	Platform angle close to 90º.
Method of reduction			
Core reduction	Majority of cores on cobble blanks. Dominance of uni- and bidirectional parallel reduction (type 3 and 5), minor presence of bipolar and multidirectional reduction.	Cores on cobble blanks. Platform, Levallois and ‘informal’ cores dominate the assemblage. ‘Informal’ cores include multidirectional cores.	Cores on cobble blanks Platform (type 1) and unidirectional parallel (types 3 & 4) cores make up the majority of SMONE. Presence of platform (type 1), uni- and bidirectional parallel (types 2-5), and bladelet cores all present in the BOS, however all in low numbers.
Core cortex present	54,5% of cores possess some level of cortex.	48,7% of cores possess some level of cortex.	NO DATA
Technological categories (based on the complete or almost complete blanks)	More than half the assemblage is unidirectional, followed	The three major orientations present in the BOS Three are unidirectional, bidirectional and	The SMONE is dominated by unidirectional (64%) orientations and a

	by bidirectional orientations (40%). Minor presence of multidirectional scars.	crossed. Cross is a minor category (>4%). Unidirectional: 23,3% and bidirectional: 6%. Unidirectional orientations more abundant than bidirectional in flakes and points (points: 70% unidirectional). 53,4% of assemblage described as indeterminate.	minor presence of bidirectional orientations. BOS is made up of a majority unidirectional (54%) and bidirectional (23%) orientations and has a minor presence of orthogonal and multidirectional dorsal scars.
Blank cross-section	Triangular (both the symmetrical and asymmetrical) is the most dominant. Data potentially skewed by large indeterminate category. Small minority of blanks present trapezoidal cross-section.	Blades, flakes and points all dominated by triangular cross-sections. Smaller presence of trapezoidal cross-sections in all three blank types.	NO DATA
Blank profile	Curved profiles (including twisted) dominate the assemblage (58%). Minority 40% represent straight profiles.	Straight profiles dominate (64% of blades, 76% of points). Minor portion of the assemblage possess curved or twisted profiles.	Bladelets possess curved and twisted profiles. All other end products have straight profiles in both SMONE and BOS.
Blanks and 'end products'	Blanks are significantly bigger/longer than available cores. Blade and bladelet size distribution is unimodal and positively skewed.	Blade size distribution is unimodal and positively skewed. Bladelet width vary more than the other layers discussed here.	Blanks are significantly bigger/longer than available cores. Blade and bladelet size distribution is bimodal.
Mean, Standard Deviation, and Co-efficient of variation to	Bladelets: Mean – 9,7 mm. Stand. Dev. – 1,3.	Bladelets: Mean – 6,5 mm. Stand. Dev. – 2.	NO DATA

understand blades and bladelets	Co-eff. of variation – 13,5. SBLS bladelets are more homogenous in width values. Blades: Mean – 20,2 mm. Stand. Dev. – 6. Co-eff. of variation – 29,9. SBLS blades are more homogenous in width values.	Co-eff. of variation – 31,2. Bladelets are generally narrower than the SBLS. There is a greater spread of values relative to the mean (due to the higher coefficient of variation) for the widths of bladelets. Blades: Mean – 21,7 mm. Stand. Dev. – 9,1. Co-eff. of variation – 41,8. There is a larger distribution of widths among the BOS Three as the standard deviation and co-efficient of variation are greater.	
Cortex Present on blanks	65,2% of blanks possess no cortex, 18,7% possesses <25% coverage.	NO DATA	SMONE: 71,6% of blanks have no cortex, 28,4% of blanks possess some level of cortex. BOS: 61,3% of blanks have no cortex, 38,7% of blanks possess some level of cortex.
Retouch, edge damage and TCSA			
Retouch and edge damage (in relation to pieces >20mm. Retouch pieces are regarded as formal tools in these assemblages)	Retouch in the assemblage relatively high. 11% of blanks possess retouch, however largely limited to one or two notches. 11% of blanks are regarded as ‘edge damaged’.	Retouch in the assemblage is rare. Only 2,2% of blanks possess retouch. 0,7% of the assemblage regarded as ‘edge damaged’.	Retouch in the assemblage is limited. In the SMONE, 0,7% of the blanks and in BOS, 2,8% of the assemblage possesses retouch. 16,4% of SMONE and 21,7% of BOS has edge damaged.

Tools types (in relation to pieces >20mm)	Presence of borers, burins, notches pieces, denticulated pieces, and scrapers.	Presence of scrapers, denticulated pieces, and notched pieces.	Presence of scrapers, denticulated pieces, and notched pieces.
TCSA	Stabbing spears are the most numerous. Arrowheads, dart tips, and javelin tips also well represented in significant numbers. Lombard's (2021) sample places the majority of SBLS in the javelin point category.	Majority of points falling in thrusting or stabbing spear categories. Less than 15% of the sample falls within the Javelin category or smaller.	75% of points are measured as thrusting and stabbing spears. 20% of the points sample can be classed as javelin tips.

APPENDIX C: ADDITIONAL LITHICs IN THE SBLS SAMPLE

Additional points

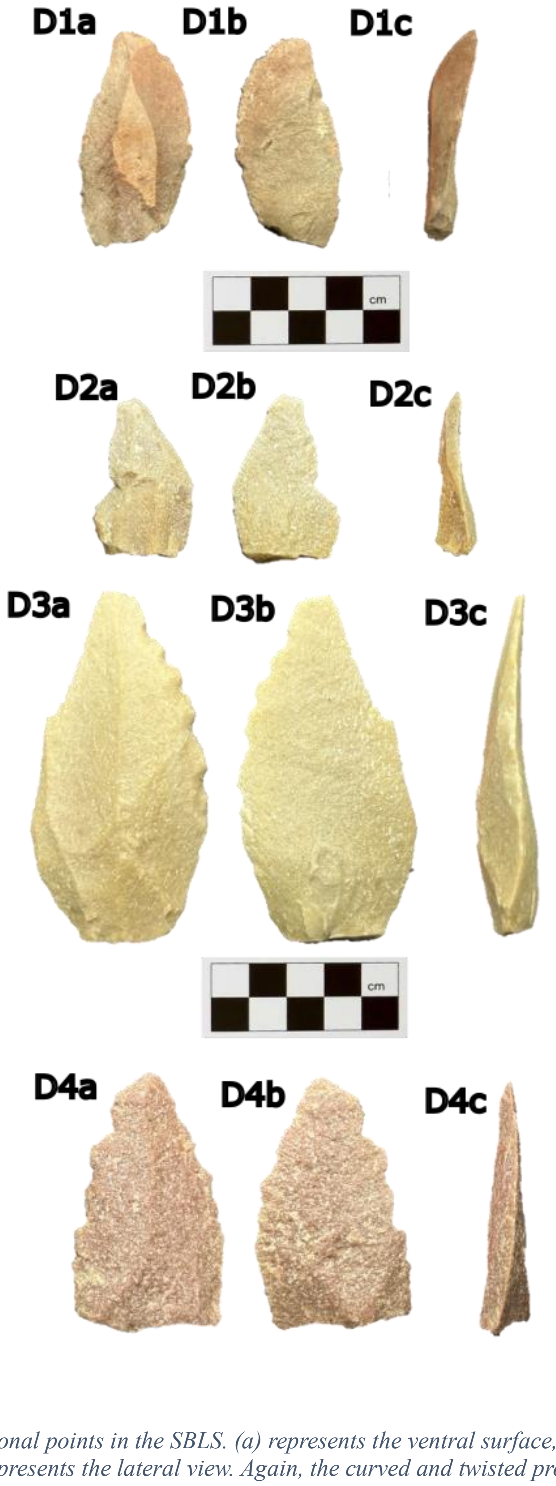


Figure 10.1 Additional points in the SBLS. (a) represents the ventral surface, (b) represents the ventral surface, and (c) represents the lateral view. Again, the curved and twisted profiles dominate the points. D1,2, and 4 are twisted, while D2 is curved.

Additional lithics of the SBLS

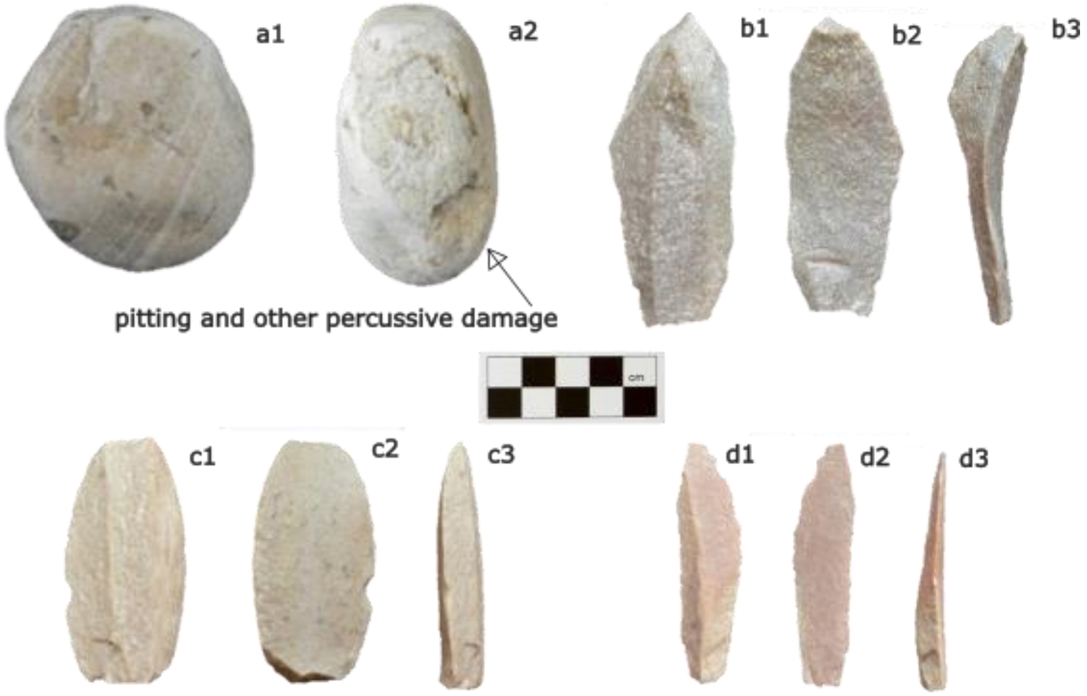


Figure 10.2 A hammerstone (a) and several blades (b-d) analysed from the SBLS. Pitting and other percussive damage is present on the one end of the quartzite cobble. Although (b) can be classed as a blade, its technological category falls under core management. (c) and (d) are further examples of the diversity of blades in the SBLS, where (c) possesses a single retouched notch therefore it may also be classed as a tool.

APPENDIX D: ADDITIONAL CORE DRAWINGS

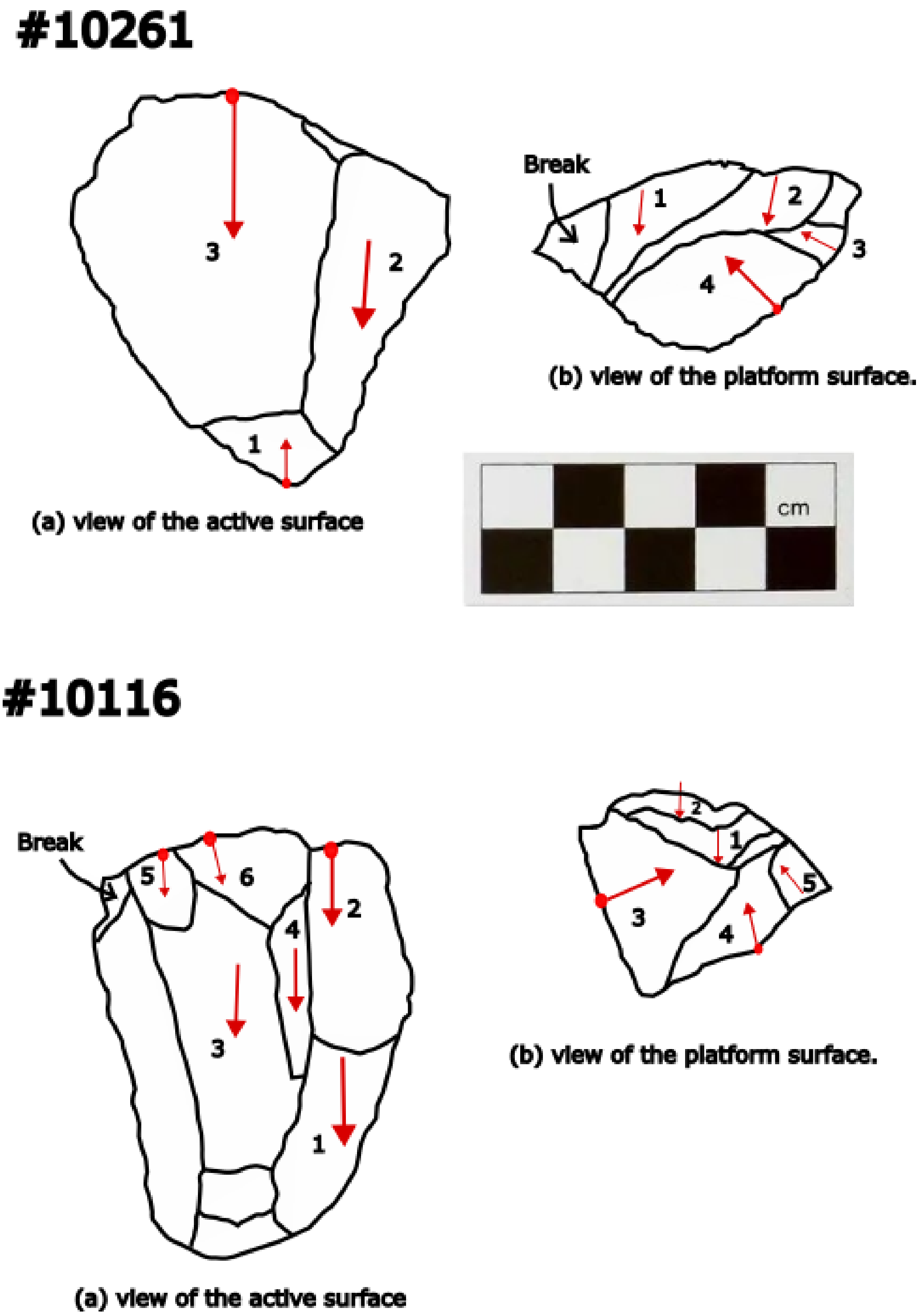
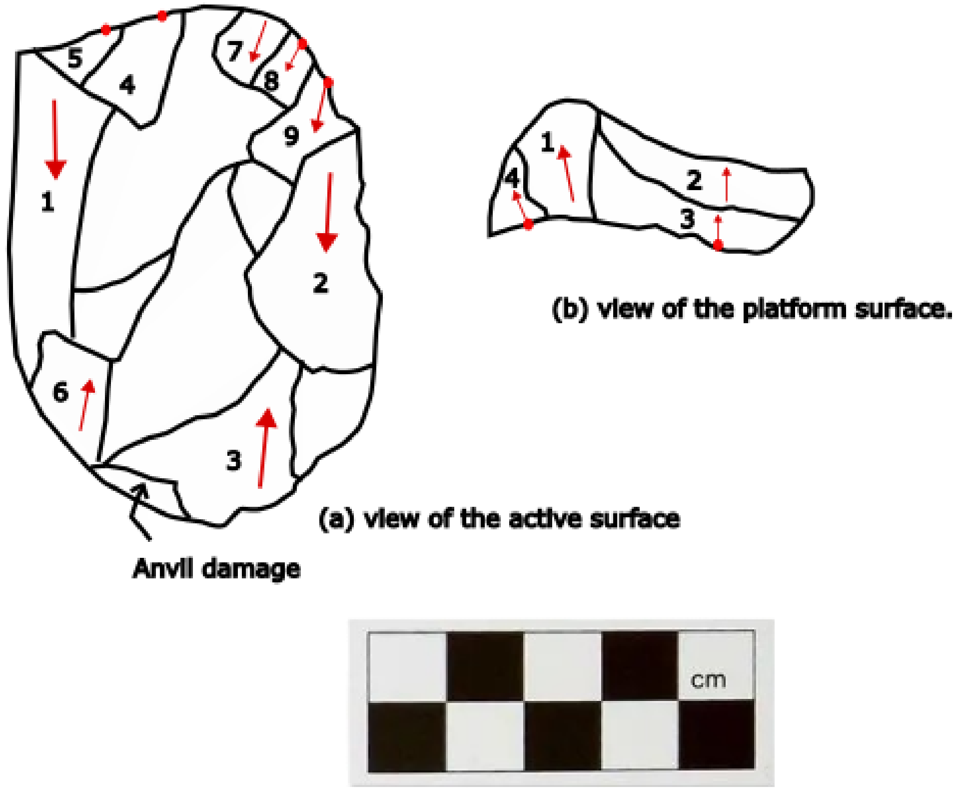


Figure 11.1 Drawings of cores #10261 and #10116. Displaying bidirectional removals, while the platforms have also undergone substantial faceting.

#9370



#11000

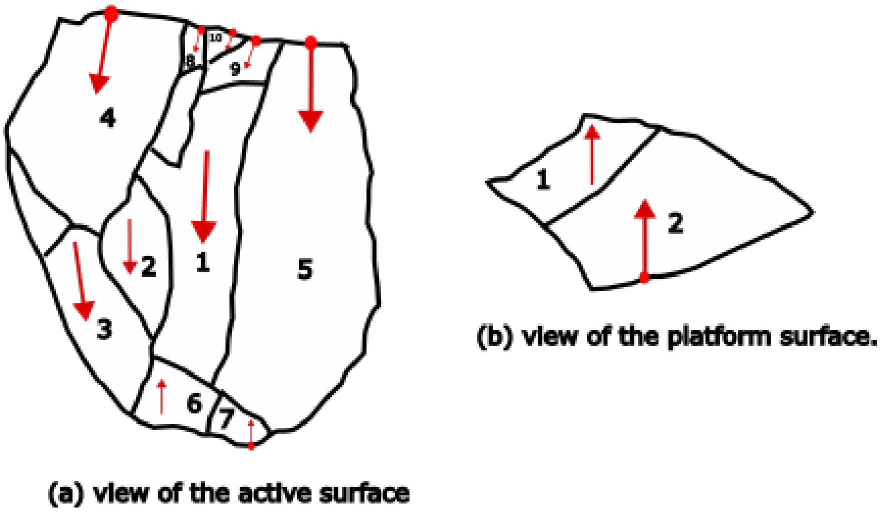


Figure 11.2 Drawings of cores #9370 and #11000. Again, the cores are bidirectional and #9370 displays evidence of possible anvil damage which has been used to infer possible bipolar reduction strategies.