THE SAME BUT DIFFERENT?

A COMPARATIVE LITHIC STUDY OF THE CAVE OF HEARTHS PIETERSBURG AND KLASIES RIVER MSA II TECHNO-COMPLEXES.

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This dissertation is submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, 2021, in fulfilment of the requirements for the degree of Master of Science

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.

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Signature

10/11/21

Date

Abstract

Middle Stone Age (MSA) lithic technology serves as a window into early *Homo sapiens* behaviour. The lithic technology within the MSA especially that predating the pre-Still Bay needs more intensive investigation from a comparative perspective to increase understanding of early *Homo sapiens* technology and occupation patterns. In recent studies, the Pietersburg has been compared to the MSA II while other studies refer to the Pietersburg as a regional expression confined to the interior of South Africa. In this study assemblages of the Pietersburg from Cave of Hearths (CoH) and MSA II from Klasies River Main site (KRM) were subjected to technological analysis following the *chaîne opératoire* approach. The comparison of these two assemblages revealed differences in flaking systems and implement types. In the Pietersburg assemblage preferential flake Levallois reduction methods dominated while platform reduction methods were most common in the MSA II assemblage. Techniques used to produce the blades and flakes in MSA II were ambiguous. The points from this assemblage, however, were probably made using hard hammer percussion technique. The Pietersburg blanks were all likely made using hard hammer percussion. Retouch was more common in the Pietersburg assemblage where unifacial points were a prominent tool type. No unifacial points were found in the MSA II assemblage and denticulates dominated. The interconnectedness between groups from the two sites during the MIS 5 was also investigated and it was concluded that coalescence between these two broadly contemporaneous sites during the MIS 5 is unlikely because of the dissimilarity of flaking systems and implement types. Based on the technological differences of the assemblages studied here the Pietersburg from CoH and MSA II from KRM do not form part of the same cultural entity, whether it be a techno-complex or industry.

Key words: Lithic technology, Middle Stone Age, Pietersburg, MSA II, Mossel Bay, Regionalization, MIS 5, Tecno-complex, Cave of Hearths, Klasies River Main site.

Acknowledgements

Professor Sarah Wurz

I cannot express my gratitude enough for your support, endless guidance and patience during the writing of this dissertation. Thank you, for sharing your wisdom and experience with me.

NRF

I would like to express my sincere gratitude to the National Research fund for their financial support with which this research would not have been possible.

Family

Family, thank you for your support and encouragement. Thank you for listening to my theories and discussions even though you did not always understand. Thank you for believing in me and pushing me to research for the stars.

Contents

List of Tables

List of Figures

Chapter 1 INTRODUCTION

1.1 INTRODUCTION

The Middle Stone Age (MSA) is extensively studied because of research interest in this period, due to origins of *Homo sapiens* linked to this time. The Mossel Bay (MSA II) and Pietersburg both early on identified as ‘variants’ of interests, are compared here to investigate these lithic technologies and regionalization during Marine Isotope Stage (MIS) 5. MIS 5 has the potential to provide further understanding on the evolution of “modern human behaviours” and as such has received increased research attention over recent years. During the middle 1950s, the Pietersburg was probably one of the most comprehensively described lithic entities in Africa. Interest in the Pietersburg has grown over the last couple of years and more information on the lithics associated with this site has become available. In many studies, the Pietersburg is related to the MSA II. This thesis will analyse, technologically, a MSA II assemblage from Klasies River Main site, a site acclaimed for its lengthy MSA occupation and paleoanthropological significance (Singer & Wymer 1982; Wadley 2015; Grine *et al.* 2017). Technological analysis will further be carried out on on a Pietersburg assemblage from Cave of Hearths, a site that also exhibits a long occupational sequence (Mason 1988, 1962; McNabb & Sinclair 2009). The technological studies of the two assemblages will be compared to assess their likeness and investigate the possible presence of regionalization and interconnectedness of the occupants of the sites during the MIS 5.

1.2 RESEARCH QUESTION

Do the assemblages from Bed 5 from Cave of Hearths (Pietersburg) and Cave 1 layer BOSThree (MSA II) from Klasies River Main site belong to the same techno-complex or industry?

1.3 AIM

To compare the lithic technology of the MSA II from Klasies River Main site, with the Pietersburg from Cave of Hearths.

1.4 OBJECTIVES

1. To provide a technological description of lithics with stratigraphic context from Bed 5 from the Cave of Hearths using a *chaîne opératoire* approach.
2. To provide a technological description of the lithics of the BOSThree from Klasies River Main site using a *chaîne opératoire* approach.
3. To technologically compare the assemblages from BOSThree from KRM, and Bed 5 from CoH.
4. To evaluate the usefulness of the current notion or concept of a "techno-complex" to compare them.

1.5 RATIONALE

The Middle Stone Age (MSA) is a period in which many pivotal aspects of "behavioural modernity" unfold (Foley & Lahr 2020). Many of these aspects have been associated with the emergence of more complex social behaviour (McBrearty & Brooks 2000; Mackay *et al.* 2014; Wadley 2015) and complex cognition (Wadley 2015). Certain periods of the MSA have been greatly emphasized such as the MIS 4 honoured for the so-called "innovative" technologies present during this time (Wadley 2015). Other periods like the MIS 5, were neglected for some time (Schmid *et al.* 2016) but have recently received increased attention (Wilkins *et al.* 2017; Nel *et al.* 2018; Brenner & Wurz 2019; Schmid *et al.* 2019; Douze *et al.* 2020; Pazan *et al.* 2020). This pre-Still Bay period of the MSA needs more meticulous investigation to facilitate understanding of *Homo sapiens* technology and occupation patterns.

In the early 1980s, numerical sequences were created to subdivide the MSA (Table 1.1). The Pietersburg has been compared to MSA II (Sampson 1974; Wurz 2002, 2013) or MSA2b as referred to by Volman (1981, 1984). More information however is needed to support these comparisons. Although the Pietersburg industry has previously been compared with the MSA II there has not been a detailed comparative study between the Pietersburg and the MSA II from the southern Cape coast. Thus, one assemblage from a coastal site (KRM) belonging to MSA II was chosen to compare with the Pietersburg from CoH.

TABLE 1.1: PROPOSED SUB-PHASES OF THE MSA AND THEIR RELATIVE AGES (ADOPTED FROM WURZ 2002).

WURZ 2002	SINGER & WYMER	VOLMAN	DATES ASSOCIATED WITH SUB-PHASES
POST- HOWIESONS POORT	MSA III & MSA IV	Post-Howiesons Poort	65ka – 22ka
HOWIESONS POORT	Howiesons Poort	Howiesons Poort	< 70 000
STILL-BAY			< 80 000
MOSSEL BAY	MSA II	MSA 2b	< 100 000
KLASIES RIVER	MSA I	MSA 2a	< 115 000

Re-examining the assemblage from Cave of Hearths could provide more information about the Pietersburg’s place within the South African MSA sequence. The comparison of the Pietersburg with the MSA II would contribute to understanding the extent of regionalization during the MSA. Regionalization during the MSA has previously been explored (Mackay *et al.* 2014; Schmid *et al.* 2016). It has previously been suggested that the Pietersburg might support the idea that regionalization was present during MIS 5 (Porraz *et al.* 2018). Porraz *et al.* (2018:38) noted that if the Pietersburg is a local variation it would suggest that true techno-cultural regionalization was present during the early MSA as suggested by Clark (1959). The Pietersburg as a local variant would also correspond to Mackay *et al.*'s (2014:21) hypothesis that MIS 5 groups had less contact with each other than MIS 4 groups. This study will thus contribute by showing in detail how broadly contemporaneous sites from the coast and inland compare. Having more information about regionalization during the MIS 5 will also contribute to a more comprehensive understanding of technological and behavioural variation within this period. Consequently, this information can be used to investigate complex cognition and social behaviour linked to this period.

1.6 SITE BACKGROUND

1.6.1 Klasies River Main site

The MSA II assemblages studied here were excavated at Klasies River Main site (KRM). KRM is a set of 4 coastal caves namely, Caves 1, 1A, 1B, and 2 (Fig. 1.1), located just outside of Humansdorp. The site is in the Eastern Cape, is situated on the Tsitsikamma coast and is part of a cultural landscape that has received National Heritage status (Wurz *et al.* 2018). The site was first excavated by Singer & Wymer from 1967-1968, then by Deacon (Deacon 1995), and excavations are currently led by S. Wurz (Wurz *et al.* 2018). KRM is well-known for its extensive MSA assemblages, which have been well researched (Wadley 2015). The MSA II techno-complex from KRM has been described by Singer & Wymer (1982) and Volman (1981, 1984), who refer to it as MSA 2b, as well as by Wurz (2002) who refers to it as the Mossel Bay. More recently excavated MSA II material from the witness baulk from Cave 1 has been studied by Wurz *et al.* (2018), Brenner & Wurz (2019), and Brenner *et al.* (2020). KRM is not only valued for its MSA lithic assemblages but also its role in paleoanthropological studies. The site has produced several MSA human fossils (e.g., Grine *et al.* 2017) and data from this site have been used in discussions of the emergence of modern human behaviour (Deacon & Schuurman 1992; Wurz 2008; d'Errico 2012). Evidence from KRM has also been used to reconstruct MSA paleoenvironments of the Cape region (Klein 1976; van Pletzen-Vos *et al.* 2019: Reynard & Wurz 2020). The reconstruction of the KRM paleoenvironment has further provided information on the diet of MSA hunter-gatherers (Kyriacou *et al.* 2014; Larbey *et al.* 2019). KRM further shows how these MSA hunter-gatherers adapted to and exploited the coastal environment (Thackeray 1988; Langejans *et al.* 2012; 2017; Will *et al.* 2016; Brenner *et al.* 2020) and how the exploitation of shellfish might have had nutritional benefits (Kyriacou *et al.* 2014). The assemblage used for this study were excavated by Wurz between 2015 – 2018. The assemblage comes from the witness baulk in Cave 1 (Fig. 1.2), layer BOSThree.

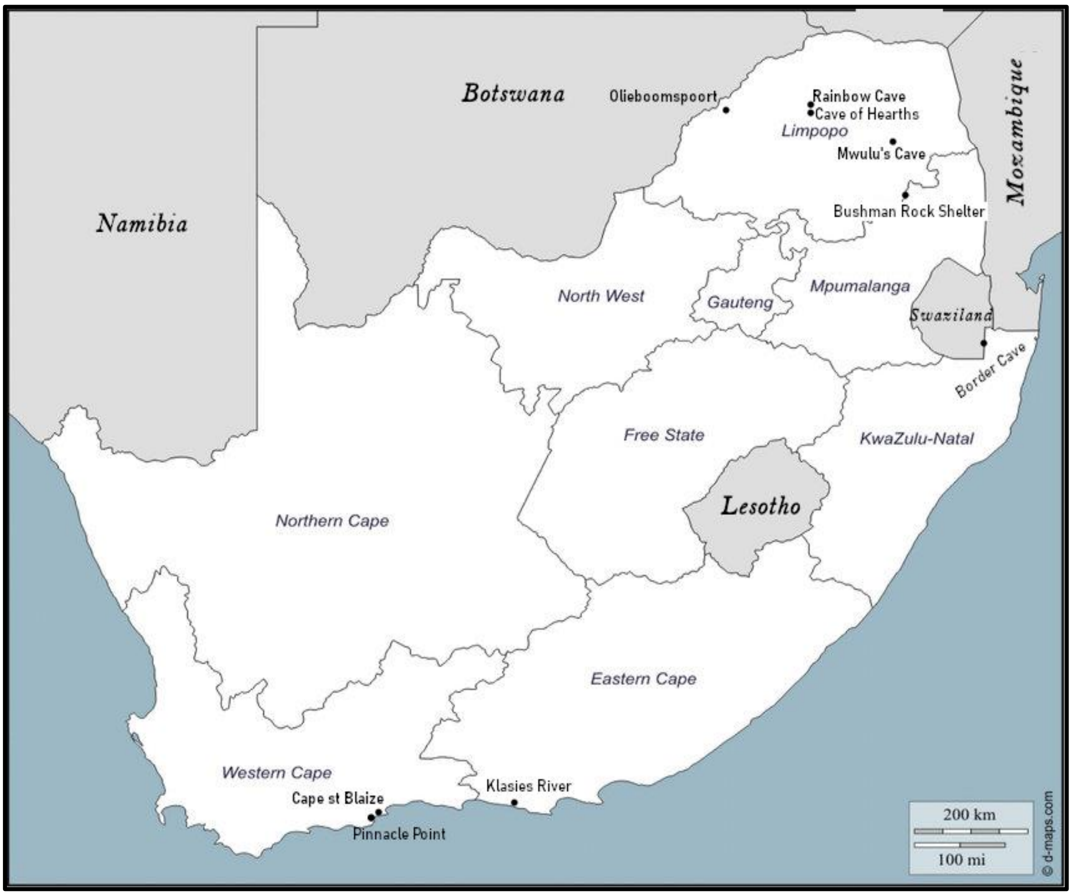

Figure 1.1: Map of southern Africa with relevant site locations.

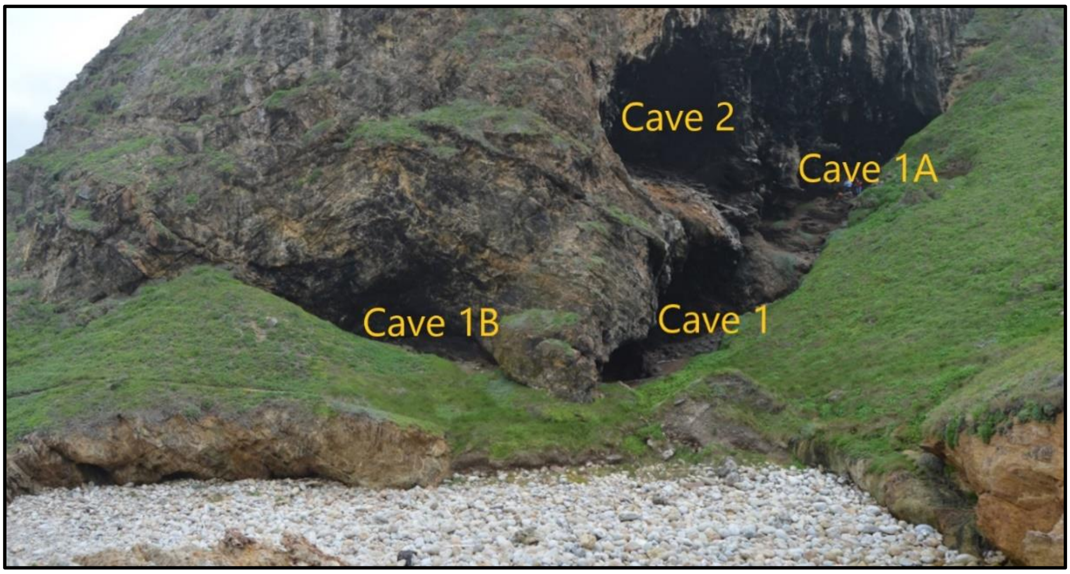

Figure 1.2: Image showing the location of caves at KRM.

1.6.2 Cave of Hearths

Cave of Hearths (CoH) is situated on the southern slopes of the Makapan cave valley which is a world heritage site (Fig. 1.3). Systematic excavation of CoH was started in 1947 by G. Gardiner and J. Kitching (McNabb & Sinclair 2009). In 1953, R. Mason (1988) took over the excavation of the site until 1954 (McNabb & Sinclair 2009). The excavations revealed that the cave was intermittently occupied from the ESA until the Iron Age period (McNabb & Sinclair 2009). CoH has produced hominid remains (Tobias 1971) and ESA, MSA, and LSA lithics (McNabb & Sinclair 2009). The evidence from CoH was also used to study the social landscape of the Acheulean hominins and their relationship with their immediate environment (McNabb & Sinclair 2009). The long occupation sequence (Beds 1-9) further provides information about technological change through time at CoH, as well as technological change between MSA sites (Mason 1957; Mason 1962; McNabb & Sinclair 2009; de la Peña *et al.* 2019). The MSA section is made up of Beds 4-9. In 1962, Mason used the Pietersburg lithics from Beds 4-9 to formally define the Pietersburg. Mason (1957; 1962) described beds 4-9 as Pietersburg, but contrary to this Sampson (1974) suggests that the Pietersburg at CoH ended in Bed 5. Both Mason (1957;

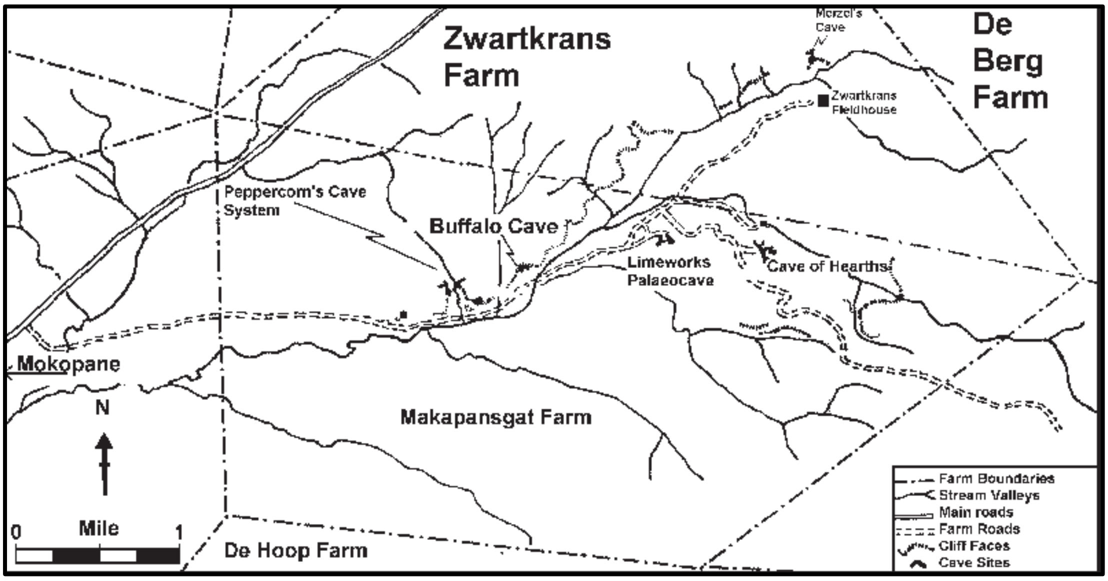

Figure 1.3: Location of Cave of Hearths in the Makapan Valley (Latham & Herries 2004)

1962) and Sampson (1974) agree that Beds 4-5 belong to the Pietersburg although they suggest different phases based on typological variations. Beaumont & Vogel (2006) however, proposed that Bed 4 belongs to middle Fauresmith. Bed 5 has not been ascribed to any other industry and is generally agreed to belong to the Pietersburg. The Pietersburg analysed in this study comes from the Cave of Hearths (CoH) Bed 5 (120-132 inches below datum) excavated by Mason.

Chapter 2 LITERATURE REVIEW

This chapter examines the use of terminology, briefly discusses the relevant cultural stratigraphic units, their associated sites, and reviews the MIS 5. The first section of this chapter gives a summary of the use of terminology regarding cultural stratigraphic units. This section also mentions prevailing problems surrounding current terminology and how it will be addressed in this dissertation. Following this is a succinct description of relevant cultural phases namely the Pietersburg, MSA II and their associated sites, Cave of Hearths (CoH), and Klasies River Main site (KRM). Finally, this chapter looks at technology in MIS 5 in a broader context, including regionalization and cognition during this time.

2.1 HISTORY, PROBLEMS, AND CONTEMPORARY USE OF TERMINOLOGY.

Terminology is the building block of eloquent descriptions of archaeological data. Different fields of archaeology like lithic specialists rely on terminology to communicate findings. However, when terminology is ambiguous, with imprecise definitions that change from author to author, it leads to misinterpretation and incompatibility among studies. This section starts with a discussion of previous attempts made to improve the use of terminology in archaeology. Following this is a brief history of the evolution of terms used to describe cultural stratigraphic units in the Stone Age of Africa including *Culture*, *Industry,* and *Techno-complex*. This section concludes with recent suggestions made regarding terminology and how these suggestions will be implemented throughout this dissertation.

2.1.1 The evolution of terms used to describe cultural stratigraphic units in Africa.

Culture is one of the earliest terms used to describe a cultural stratigraphic unit at a site. Table 2.1 shows that the term *Culture* featured frequently in publications prior to 1970. In Goodwin & van Riet Lowe's (1929) book there is no specific definition for their use of *Culture,* but they seem to use it in a way that denotes the social behaviour and customs of a group of people. In this definition, lithics are used to define the *Culture* of a group. Mason (1957) however uses *Culture* in a more technological sense and defines it as, "*similar industries, each industry consisting of artefact classes or groups of similar tools"* (Mason 1957:119). The term *Culture* is used by several other authors, for example in regard to the Pietersburg, although which definition of *Culture* they mean is unclear i.e. van Riet Lowe (1954), Cooke *et al.* (1945), Tobias (1949), and Malan (1950).

At the Burg Wartenstein symposium of 1966, several attempts were made to clarify the use of terminology in archaeology in Africa. An issue raised, relevant to this discussion was the lack of standardization of terms which hampered interpretation. It was thus proposed that cultural stratigraphic units should be defined using the terms: *Industrial Complex, Industry, Phase,* and *Archaeological Horizon* or *Archaeological occurrence* (Clark *et al.* 1966). The goal of this symposium was to make communication between archaeologists easier with more precise language to limit confusion.

At the Burg Wartenstein symposium it was further suggested that the term *Culture* should be abandoned as it had other connotations and was previously used to mean *Industrial complex* and/or *Industry* (Clark *et al.* 1966: 114-115). The use of the same term to mean different things is one of the issues addressed at this symposium (Clark *et al.* 1966). However, two years after the symposium Clarke (1968) resurrects the use of *Culture* in his hierarchical descriptions of cultural stratigraphic terms (Fig. 2.1). Clarke's book Analytical Archaeology (1968) was a second attempt to standardize terms. This book specifically focused on terms used for cultural stratigraphic units explaining them by using analogies and hierarchical levels (Clarke 1968). Clarke (1968) explained different terms at length and proposed new definitions. His definitions, however, received criticism for being ambiguous and lacking rigour (Steigler 1971). The suggestions made at the Burg Wartenstein symposium and by Clarke (1968) tried to resolve already existing problems with terminology.

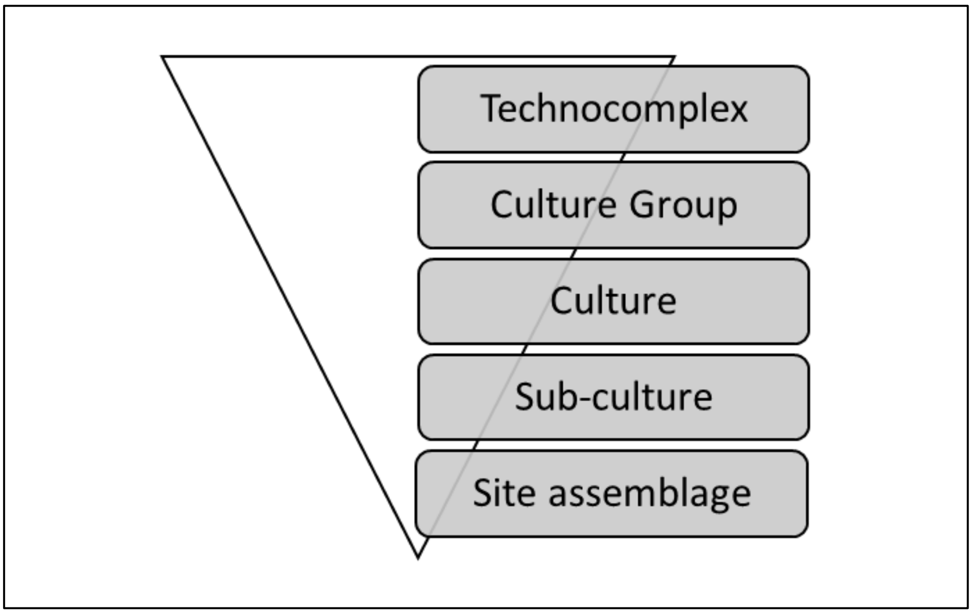

FIGURE 2.1: HIERARCHY OF CULTURAL STRATIGRAPHIC UNITS AS DESCRIBED BY CLARKE (1968).

In contemporary archaeological literature, *Culture* is rarely used and has in theory been replaced by *Industry*. Clarke (1968) does not include *Industry* in his hierarchy but based on the definition he gives for *Industry* it may be synonyms with *Culture*. The definition he gives for *Industry* is, "*A set of single-material artefact-type assemblages from a continuous space-time area, taxonomically linked by the mutual technological affinities. Frequently, a single material aspect from a techno-complex entity"* (Clarke 1968:492). This definition bears some resemblance to the one proposed at the Burg Wartenstein symposium which defines *Industry* as: "*An Industry is represented by all the known objects that a group of prehistoric people manufactured in one area over some span of time*" (Clark *et al.* 1966: 115). Both definitions of *Industry* mention that it is restricted to a time and geographic location. Similarly, Deacon (1980) defined *Industry* as the geographical expression of a more widespread *Industrial Complex*. Lombard *et al.* (2012) state that changes in technology across space may be expressed as distinct *Industries* or *Regional Variants* that are found less widely than *Techno-complexes* but are still present at many sites. However, these definitions of *Industry* do not include measurable units but instead uses vague terms such as one area, some span of time, widespread, and a geographical location.

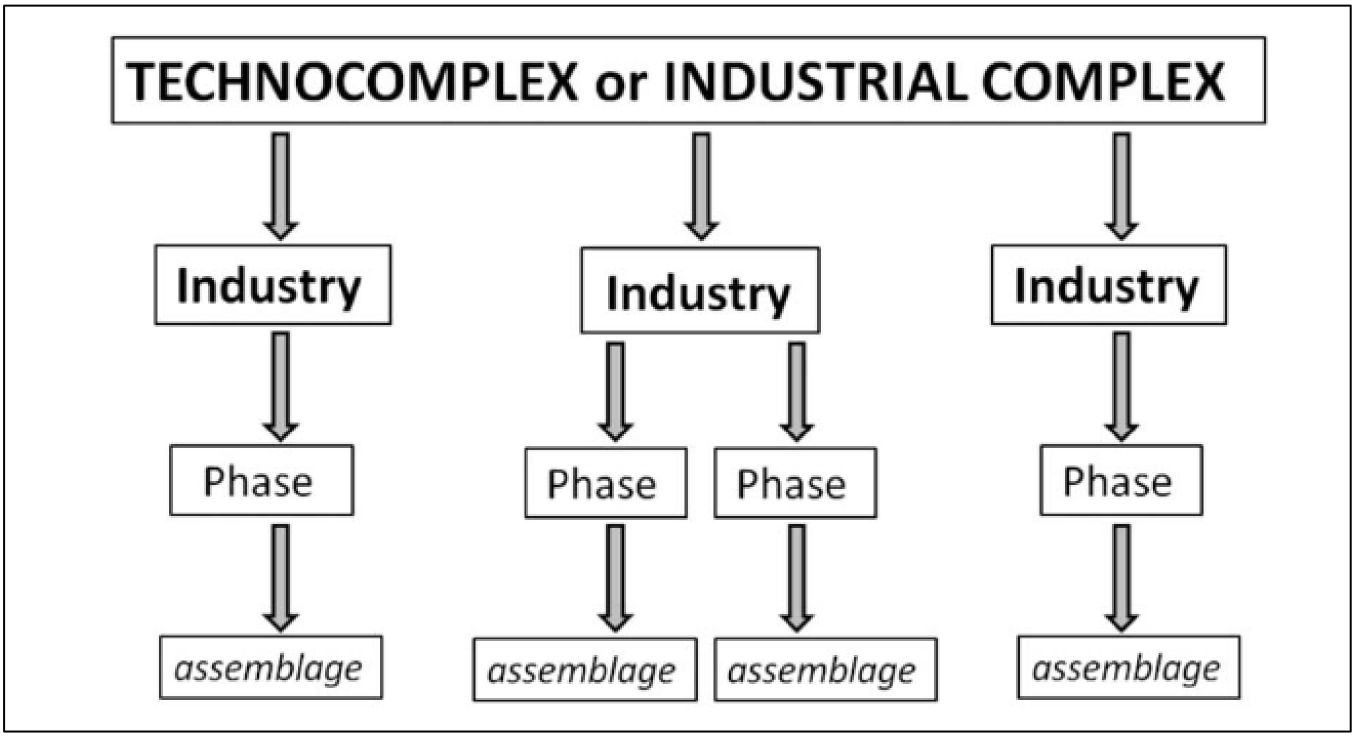

FIGURE 2.2: THE HIERARCHY OF CULTURAL STRATIGRAPHIC UNITS AS DESCRIBED BY WADLEY (2015)

Many problems related to the term *Industry* are mirrored in the definitions of *Techno-complex*. The term *Techno-complex*, first used in *Analytical Archaeology* (Clarke 1968), is still used today. *Techno-complex* is in the highest position of Clarke's (1968) hierarchy (Fig.2.1). Clarke (1968) defines *Techno-complex* as, "*a group of cultures characterized by assemblages sharing a polythetic range but differing specific types of the same general families of artefact-types, shared as a widely diffused and interlinked response to common factors in environment, economy, and technology"* (Clarke 1968: 330). Deacon (1980) defines *Industrial Complex* as, *"A common tradition of artefact manufacture, that is widespread"* (Deacon 1980: 2). Once again, these definitions use words like, "very large area" and "widespread" that are difficult to measure. This also makes it difficult to know when *Industries* should be placed into a *Techno-complex*. Kleindienst (2006) notes that it is unclear what level of similarity cultural evidence should have to be included in a *Techno-complex*. Another issue is that the terms *Industry* and *Techno-complex* are used interchangeably (Table 2.1). A good example is the Mossel Bay

(MSA II) which is referred to as *Techno-complex*, *Industry,* and *Sub-phase* by Lombard *et al.* (2012), *Techno-complex,* and *Industry* by Wurz (2013), and *Techno-complex* and *Industry* by Wadley (2015). Lombard *et al.* (2012), note differences between *Techno-complex* and *Industry* at the beginning of their article and place *Industry* lower in their hierarchy than *Techno-complex* (Fig. 2.2). Later on in the publication, the terms are used interchangeably (Lombard *et al.* 2012). Further complications arise when similar names are assigned to *Techno-complexes* and *Industries*. This issue was touched on at the Burg Wartenstein symposium where it was suggested to use site-specific names to avoid confusion. However, this, like the suggestion to discard the use of Early Stone Age, Middle Stone Age, and Later Stone Age made at the symposium was not followed (Kleindienst 2006).

In his book "*The Stone Age Archaeology of Southern Africa*" Sampson (1974) groups relevant information about the stone age of southern Africa together. He further attempts to apply the suggestions made at the Burg Wartenstein symposium to this information. He thus uses the term *Industry* to describe "*similar samples from multiple sites*", *Industrial Complex* to refer to "*a group of similar samples covering a large area*" and completely removes the term *Culture* (Sampson 1974:6). Sampson explains that a new term was only adopted when "*a group of samples shared numerous distinctive features that may include typology*" (Sampson 1974:9). Although Sampson used the suggested definitions of the Burg Wartenstein symposium, the inherent ambiguity of the definitions still impedes succinct and clear descriptions of cultural stratigraphic units.

Sampson (1974) describes Bed 5 of CoH as having a high percentage of flakes that are broader and smaller than their earlier counterparts. He also refers to the Pietersburg as a *Complex* (Sampson 1974). By doing this he indirectly states that groups of samples similar to that found at Cave of Hearths are present at sites covering a large area, as per his definition quoted in the previous paragraph (Sampson 1974). This is in line with Sampson's (1974) description of at least two other sites containing the Pietersburg "*Complex*", namely, Asvoëlkop and Mwulu's Cave. Sampson (1974) also describes the Mossel Bay *Industry* under which he lists the MSA II at Klasies River Main site. He describes this industry as being blade core rich, lacking triangular and convergent flakes, and having a low percentage of utilized flakes (Sampson 1974). By referring to the Mossel Bay as an *Industry* Sampson (1974) again indirectly states that the Mossel Bay *Industry* consists of multiple similar samples from sites that are relatively close to each other. This fits with Sampson's (1974) description of five other sites containing the Mossel Bay Industry confined to the southern and western Cape. These sites include Skildergat, Die Kelders, Montagu, Cape st. Blaize and Klasies River Mouth (Sampson 1974).

2.1.2 Recent suggestions to clarify the use of terminology.

According to Sauer and Riede (2019), unambiguous definitions of cultural stratigraphic units are vital to study past processes of cultural change. A renewed call for (1) consistent criteria for definitions and delimitation of terms, (2) clear taxonomic systems in which entities can be placed, and (3) agreement on the meaning of their ranks have been made by Sauer and Riede (2019). Adding a comprehensive list of definitions of terms used in a publication as they are understood by the authors seems to be the only way forward as authors seem to be intent on avoiding and disregarding attempts made to standardize language.

Following the recommendations of Sauer and Riede (2019) the terms *Industry* and *Techno-complex* will be defined here as they will be used throughout this dissertation. These definitions are not without fault or suggested to replace other definitions of the same terms but rather an attempt to inform the reader how the terms will be used within this dissertation. The term *Techno-complex* will be used to refer to a group of assemblages that 1) exhibit comparable technologies in relation to implementing type and flaking systems (2) are broadly contemporaneous and (3) are found at many sites spanning more than one rain fall zone. *Industry* will be used to refer to a group of assemblages that (1) exhibit comparable implement types and flaking systems (2) are broadly contemporaneous and (3) are present at many sites but restricted to a rainfall zone. It is important to clarify that based on these definitions many *Industries* do not make up a *Techno-complex,* but *Industries* can be upgraded to the level of *Techno-complex* if/when it is found in more than one rainfall zone.

TABLE 2.1: PROVIDED HERE IS THE TERMINOLOGY ASSOCIATED WITH DIFFERENT UNITS STUDIED IN THIS DISSERTATION.

	CULTURE	**INDUSTRY**	**VARIATION**	**TECHNO-COMPLEX/ INDUSTRIAL COMPLEX/ COMPLEX**	**SEQUENCE/SUB-PHASE**	**NOT SPECIFIED**
MSA I		Backwell *et al.* 2018 Wadley 2005 Wurz *et al.* 2003 Backwell *et al.* 2018		Schmid *et al.* 2019 Langejans *et al.* 2017 Wurz 2012 Brenner & Wurz 2019 Larbey *et al.* 2019 Nel *et al.* 2018 Will *et al.* 2016 Lombard *et al.* 2012 Dusseldorp *et al.* 2013	Thackeray & Kelly 1988 (Sequence) Kandel *et al.* 2016 (Sub-phase) Wurz *et al.* 2003 (Sub-phases) Thompson & Marean 2008 (Sub-phase) Henshilwood *et al.* 2002 (Sub-phase)	Schmid *et al.* 2016 Thompson *et al.* 2010 Clark & Plug 2008 Wadley 2015 Will *et al.* 2013 McCall 2007 Langejans *et al.* 2012 D'Errico & Stringer 2011 Mackay *et al.* 2014 Porraz *et al.* 2018
MSA II		Henshilwood 2008 Wurz *et al.* 2003		Schmid *et al.* 2019 Langejans *et al.* 2017 Wurz 2012 Brenner & Wurz 2019 Larbey *et al.* 2019 Nel *et al.* 2018 Will *et al.* 2016 Lombard *et al.* 2012 Dusseldorp *et al.* 2013	Thackeray & Kelly 1988 (Sequence) Wurz *et al.* 2003 (Sub-phases) Kandel *et al.* 2016 (Sub-phase) Thompson & Marean 2008 (Sub-phase) Henshilwood *et al.* 2002 (Sub-phase)	Thompson *et al.* 2010 Clark & Plug 2008 Wadley 2015 Will *et al.* 2015 McCall 2007 Langejans *et al.* 2012 D'Errico & Stringer 2011 Thackeray 1989 Mackay *et al.* 2014 Porraz *et al.* 2018

Pietersburg	Cooke *et al.* 1945 Harcus 1947 Tobias 1949 Tobias 1954 Van Riet Lowe 1954 Malan 1950 Daniels 1967 Mason *et al.* 1958 Mason 1957	Cooke *et al.* 1945 Tobias 1949 Wadley *et al.* 2016 Backwell *et al.* 2018 Porraz *et al.* 2018 Porraz *et al.* 2015 de la Peña *et al.* 2018 Klein 1970 McBrearty & Brooks 2000 Mason 1957 Wadley *et al.* 2016 Butzer *et al.* 1978 Wurz 1999 Thackeray 1992 Backwell *et al.* 2018 de la Peña *et al.* 2019 Val *et al.* 2021	Goodwin & van Riet Lowe 1929 Lombard *et al.* 2012 Klein 1970 Harkus 1947	Porraz *et al.* 2018 Porraz *et al.* 2015 Sampson 1974 Schmid *et al.* 2019 Henshilwood & Dubreuil 2011 Wadley 2015 Schmid *et al.* 2016 Will & Conard 2018 Wurz 2014 Douze *et al.* 2015 Thackeray 1992	Schmid *et al.* 2019 (Sequence) Wadley *et al.* 2016 (Sequence)	Beaumont & Vogel 2006 De Villiers 1973 Lombard *et al.* 2012 Schmid *et al.* 2016 Douze *et al.* 2020

2.2 The cultural phases at Klasies River and Cave of Hearths.

In this section, there is an overview of the MSA II, and Pietersburg, the entities for which lithic analysis is being undertaken in this dissertation. Both of these entities appear in the MSA, a period marked by the absence or rarity of large cutting tools (Brooks *et al.* 2018). The section then briefly looks at the history of these two entities and their presence at various sites in South Africa. Following this is a more detailed summary of the technological information currently available for the MSA II at Klasies River and the Pietersburg at Cave of Hearths.

Figure 2.3: A map of sites mentioned in the following paragraphs: Apollo 11 (AXI), Blombos Cave (BBC), Border Cave (BC), Bushman Rock Shelter (BRS), Cape St. Blaize (CSB), Cave of Hearths (COH), Diepkloof Rock Shelter (DRS), Die Kelders (DK), Elands Bay Cave (EBC), Hoedjiespunt (HDP1), Klasies River Mouth (KRM), Klipfonteinrand (KFR), Mwulu's Cave (MC), Melikane (Mel) Nelson Bay Cave (NBC), Olieboompoort (OLI), Pinnacle Point (PP), Rose Cottage Cave (RCC), Sea Harvest (SH), Sibudu Cave (SC), Wonderwerk Cave (WWC), Ysterfontein (YFT)

2.2.1 MSA II

In the early 1980s, numerical sequences were created to subdivide the MSA. These stages were created based on typological and morphological attributes (Wadley 2015). The KRM sequence was used by Singer & Wymer (1982) to divide the MSA at the site into four sub-stages MSA I, MSA II, Howiesons Poort, and MSA III. Volman (1981, 1984) also developed a numerical sequence dividing the MSA into MSA 1-3 based on a comparative study of several sites in the Eastern and Western Cape province. At Klasies River he equated the MSA I with the MSA 2a, and MSA II with the MSA 2b. Wurz (2002; 2013) subsequently refers to the MSA II as the Mossel Bay sub-stage. The term MSA II (Mossel Bay) at KRM will hereafter be used as it has wider relevance. This sub-stage has also been noted at Pinnacle Point (PP) and Cape St Blaize (CSB) (Thompson & Marean 2008; Thompson *et al.* 2010) (Fig. 2.3). The Cave 13B assemblages from PP bear some resemblance to the MSA II from KRM described by Wurz (2002), although some variation is apparent (Thompson *et al.* 2010). These differences include changes in core reduction strategies and inter-site variability reported by Wurz (2002), such as differences in retouch frequency and core reduction strategies between MSA I and MSA II. The differences noted by Wurz (2002) were not found in the PP assemblages (Thompson *et al.* 2010). Thompson *et al.* (2010) also suggest that the PP 13B assemblage typologically resembles the KRM assemblage rather than technologically. Similarly, the Mossel Bay collection from CSB has similarities to the MSA II assemblages from KRM with some differences (Thompson & Marean 2008). One of the differences reported is the variation in end-products. At KRM point end-products are prominent while blades are more frequent at CSB (Thompson & Marean 2008), although Wurz (2013), mentions that blades form a significant component of the MSA II (Mossel Bay) at KRM.

The MSA II, at KRM is dominated by locally found quartzite (Wurz 2002). Parallel cores are prominent and further core analysis indicates long intense reduction sequences (Brenner & Wurz 2019). Technological analysis of the blanks shows that unipolar convergent Levallois reduction was used to achieve Levallois-like end-products (Wurz 2002, 2013) a criteria also used by (Boëda 1995). A recent analysis of MSA II-related layers at KRM also found that bidirectional reduction was used (Brenner & Wurz 2019). Technological studies of this sub-stage further suggest that free-hand percussion using a hard hammer was used (Wurz 2002; Brenner & Wurz 2019). This is based on the presence of thick platforms, straight profiles, prominent bulbs, and ring cracks (Wurz 2002; Brenner & Wurz 2019). The end-products mostly consist of flakes, blades, and points with points being the most common (Brenner & Wurz 2019). These end-product points are recognized by their carefully prepared platforms (Wurz 2002). The points are mostly asymmetrical and flake-sized with thick butts and faceted platforms (Wurz 2002; Brenner & Wurz 2019). Retouched elements include notches and denticulates. Wurz (2002) also noted that there were no unifacial or bifacial pieces within the studied assemblage.

2.2.2 Pietersburg

In 1962 Mason used beds 4-9 of Cave of Hearth (CoH) to formally define the Pietersburg industry which has also been found at Border Cave (Butzer *et al.* 1978; Backwell *et al.* 2018), Rainbow Cave (van Riet Lowe 1943; Tobias 1954; Mason 1957), Olieboomspoort (Mason 1962; van der Ryst 2006; Val *et al.* 2021), Mwulu's Cave (Tobias 1949; de la Peña *et al.* 2019), Bushman Rock shelter (Mason 1957; Porraz *et al.* 2015; Porraz *et al.* 2018) and others (see Porraz *et al.* 2018: 3). Currently, there is no date associated with the Pietersburg at CoH using modern dating techniques. The lower Pietersburg at Bushman Rock Shelter (BRS) however has been dated to 97 ka using OSL on feldspar (Porraz *et al.* 2018). A recent study of an assemblage at Mwulu's Cave associated with the Pietersburg also produced a date of 90 ka using OSL on feldspar. In their study of the Pietersburg at Olieboomspoort (OBP) Val *et al.* (2021) dated two equid teeth with Uranium series/ electron spin resonance, that produced a mean age of 150 ± 14 ka. Pietersburg is thus part of the pre-Howiesons Poort MSA, probably belonging to the Marine Isotope Stage (MIS) 5 or/and 6 period. Mason's (1962) description of the Pietersburg included dividing the industry into 3 phases namely the Early, Middle, and Later Pietersburg (Table 2.2). This study focuses on the Bed 5 lithics, described by Mason (1962) as part of the Middle Pietersburg, and Sampson (1974: 159) as part of the Later Pietersburg.

The raw material used for the Pietersburg usually depended on the local availability of raw material (Mason 1962; Porraz *et al.* 2018). At most Pietersburg sites local materials are made up of fine-grained materials (Mason 1962; Sampson 1974; Wadley 2015). In Bed 5 at the Cave of Hearths, quartzite is the most prominent (Mason 1962; McNabb & Sinclair 2009) although andesite, chert, quartz, indurated shale, basalt, hornfels, felsite, and dolomite also occur locally. Flakes are the most common blank in Bed 5, specifically convergent flakes (McNabb & Sinclair 2009). These were probably made using a unidirectional reduction sequence (McNabb & Sinclair 2009: 119). Most of the cores found in Bed 5 are classified as "other" while discoidal cores are also prominent (McNabb & Sinclair 2009: 120). According to McNabb & Sinclair (2009), the goal was to produce prepared core technology flakes including long parallel flake -blades. In this assemblage, retouch is found on convergent flakes, blades, parallel flake blades, and simple flakes (McNabb & Sinclair 2009: 130). Formal tools found in Bed 5 include backed pieces, borers, denticulates, notches, points, and scrapers (McNabb & Sinclair 2009: 113, Table 8.6).

Table 2.2: Different classifications given to CoH and related sub-stages.

Source	**Beaumont & Vogel 2006**	**Sampson 1974**	**Mason 1957, 1962**	**Singer & Wymer 1982**	**Volman 1981, 1984**	**Wurz 2002**	**McNabb & Sinclair 2009**
Bed 4	Middle Fauresmith	Early Pietersburg	Early Pietersburg	MSA I	MSA 2a	Klasies River	MSA I
Bed 5		Later Pietersburg	Middle Pietersburg	MSA II	MSA 2b	Mossel Bay	MSA I
Bed 6		Bambata	Later Pietersburg		Howiesons Poort	Howiesons Poort	MSA II
Bed 7		Bambata	Later Pietersburg		Howiesons Poort	Howiesons Poort	MSA II
Bed 8		Bambata	Later Pietersburg		Howiesons Poort	Howiesons Poort	MSA II
Bed 9							MSA II

2.3 MIS 5 IN A BROADER PERSPECTIVE.

2.3.1 Complex cognition

Complex cognition has been a popular subject in studies trying to answer the questions of how, why, and when modern behaviour came to be. A lot of focus has been put on the MSA within southern Africa as modern behaviours associated with complex cognition appear more frequently in this period (Wadley 2015). However, the MSA is a vast period spanning over 300 000 years. Further, despite being the focus of many studies the start and end of the MSA are not clear (Foley & Lahr 2020). Nevertheless, the MSA is a period associated with anatomical and behavioural modernity (Foley & Lahr 2020). Foley & Lahr (2020) describe the MSA as a dynamic period with novel behaviours, cumulative culture, and symbolism associated with modern behaviour. The development of these behaviours has also been associated with the emergence of more complex social behaviour (McBrearty & Brooks 2000; Mackay *et al.* 2014; Wadley 2015). Many studies of cognition and modern human behaviour are focused on MIS 4 Still Bay and Howiesons Poort periods (Schmid *et al.* 2016). Periods like MIS 4 have been over-emphasized because of the so-called “advanced” and “innovative” technologies found within the Howiesons Poort and Still Bay techno-complexes (Schmid *et al.* 2016; Bader *et al.* 2018). Schmid and colleagues (2016:154) note that there is a lack of early MSA studies including studies of MIS 5. MIS 5 refers to the Marine Isotope Stage spanning from 130 – 80 ka (Medley 2011). This is true for both complex cognition and lithic studies. Although relatively few MIS 5 assemblages have reliable dates this period has received renewed interest in recent years (Wurz 2013; Mackay *et al.* 2014; Douze *et al.* 2015; Nel *et al.* 2018; Brenner & Wurz 2019; de la Peña *et al.* 2019; Pazan 2020).

Lithic studies are vital to study the emergence of the human mind as the stone tool record can be used to infer cognitive change (Foley & Lahr 2020). Most MIS 5 assemblages for example show the use of Levallois techniques which have been linked to cognitive complexity. Although, the Levallois is arguably older than 300 ka and has its origins in the Oldowan (Muller *et al.* 2017). A study by Muller *et al.* (2017) compared five different core reduction strategies using the hierarchical organization as a proxy for behavioural complexity. In this study, bipolar, discoidal, prismatic blade, biface, and Levallois strategies were compared (Muller *et al.* 2017). The outcome showed that the Levallois core reduction technique was the most complex (Muller *et al.* 2017). Not only is Levallois reduction shown to be cognitively complex, but this reduction method is also repeatedly replicated during the MSA suggesting the possibility of social learning (Lycett *et al.* 2016). The lack of detailed lithic studies of MIS 5 industries influences our concept of complex cognition as well as regionalization during this period. Having more information on regional cultural expressions might challenge the current models about the emergence of behavioural complexity (d’Errico *et al.* 2012).

2.3.2 Regionalization

Distinct cultural traditions are sporadically found throughout the Pleistocene in South Africa (d'Errico *et al.* 2012; Mackay *et al.* 2014; Schmid *et al.* 2016). Cultural traditions such as ochre usage (Henshilwood *et al.* 2002; Lombard 2007; Henshilwood *et al.* 2011; Dayet-Bouillot *et al.* 2017), engraving of ostrich eggshells (Texier *et al.* 2010; Texier *et al.* 2013; Henshilwood *et al.* 2014; Hodgson 2014), pressure flaking (Mourre *et al.* 2010) and differences in lithic technologies (Wurz 2013) appear at varying times and seem to be non-directional (Mackay *et al.* 2014:1). The overall appearance and disappearances of these traditions are inadequately understood but might point to regional patterns of change (d'Errico *et al.* 2012). For example, changes in lithic technology can identify regionalization. By comparing technological methods and techniques from different sites, patterns emerge (Mackay *et al.* 2014). Obstructing the identification of regional lithic technological traditions is the fact that much focus has been put into defining cultural historical units and tool manufacturing methods associated with these units (Mackay *et al.* 2014). Mackay *et al.* (2014) rather suggest that more effort should be put into understanding the underlying mechanisms of technological change and causes of similarities between geographically scattered sites (Mackay *et al.* 2014). This can only be done if enough technological information is available, which includes defining methods and techniques of assemblages.

Regionalization of technological change has previously been discussed. For example, Goodwin & van Riet Lowe (1929), briefly mention local variations in the ESA and early MSA. They attribute these variations to changes in raw material between geographical locations (Goodwin & van Riet Lowe 1929). Clark (1988) suggests that raw material is linked to variation in assemblages but also adds environment and adaptation to ecological conditions as causes. Clark (1988) proposes that true technological regionalization was already present during the early MSA or the "arid period" at the end of the Acheulean (Clark 1988). McBrearty & Brooks (2000) also mention possible regionalization during the post-Acheulian periods. Recent studies commented on Clark's (1988) hypotheses, that regionalization was present in the early stages of the MSA, stating that more information on the so-called Pietersburg industry might reinforce his proposition

(Porraz *et al.* 2018; de la Peña *et al.* 2019). However, Clark (1988: 257) regarded the early MSA as the period that started a little over 200 ka and included anything dated to over 100 ka. Currently, it is agreed that the MSA started over 300 ka and continued until 22 ka (Wadley 2015).

2.3.2.1 Causes for regionalization.

At present, there is more focus on causes for lithic change largely aimed at change within the MIS 4. Many theories are based on information of the MIS 4 as there is little information about the MIS 5 available (Mackay *et al.* 2014; Schmid *et al.* 2016). Due to the scarcity of MIS 5 information many studies of environmental change are directed at the MIS 4, for instance, studies by McCall & Thomas (2012) and Ziegler *et al.* (2013). The theory that technological change occurs as a response to the environment has been investigated by McCall & Thomas (2012), Ziegler *et al.* (2013), and Wilkins *et al.* (2017). Wilkins *et al.* (2017) did a lithic analysis of both MIS 4 and MIS 5a-b assemblages at Pinnacle point (PP). The study determined that due to environmental changes differences could be seen in raw material acquisition patterns and flaking systems used in the respective assemblages (Wilkins *et al.* 2017). The MIS 4 assemblage showed higher levels of onsite core reduction and preference for more efficient blade-reduction strategies than the MIS 5 assemblages (Wilkins *et al.* 2017). Efficiency is deduced from four factors: dorsal scar pattern, blade frequency, edge to mass ratio, and blank to core ratio (Wilkins *et al.* 2017). The assemblage from MIS 4 shows a high frequency of uni- and bi-directional scar patterns which are associated with blade production. Blade reduction strategies are considered more efficient as they produce artefacts with larger edge to mass ratios, which results in a bigger cutting area and fewer costs associated with transportation (Wilkins *et al.* 2017). In the MIS 5 assemblage pieces with uni- and bi-directional scars are scarce and the large edge length to mass ratio is less frequent than in the MIS 4. This suggests that the MIS 5 reduction strategies were less efficient than the ones of MIS 4 (Wilkins *et al.* 2017). Wilkins *et al.* (2017) suggest that these differences are because of environmental changes caused by high latitude glacial conditions during MIS 4.

Another theory for lithic variation is that change in social stimuli and intra-group behaviour such as learning practices, altruism, and social skills should be considered as a driver for technological change (Jacobs *et al.* 2008; Bar-Yosef & Belfer-Cohen 2013). The morphology of some tools depends on a particular knapping tradition that is learned and practised within a specific social group (Bar-Yosef & Belfer-Cohen 2013). Variation in learning practices and knapping tradition can therefore result in technological variation between sites (Bar-Yosef & Belfer-Cohen 2013).

McBrearty & Brooks (2000) also note that learning practised can cause regionalization (McBrearty & Brooks 2000). They use point styles to identify regionalization, as was previously done by Clark (1988) (McBrearty & Brooks 2000). Point styles are used to identify regionalization because of the meticulousness that goes into creating a point (McBrearty & Brooks 2000). If a successful style is found, this will probably be recreated with as much precision as possible to insure further successful outcomes (Wilmsen 1974; McBrearty & Brooks 2000:498). Hunting practices were probably closely intertwined with point designs, and it was thus paramount to maintain a specific design for successful hunting (McBrearty & Brooks 2000). Older men were often responsible for making the points as their visual acuity and some stamina with age but not their ability to make points (McBrearty & Brooks 2000). This limited the transfer of point designs between groups which created distinct styles (McBrearty & Brooks 2000).

2.3.2.2 Interconnectedness and regionalization.

Regional variation in lithic technology has also been discussed by Mackay *et al.* (2014) in relation to interconnectedness. They suggest that changes in interconnectedness may explain the sporadic appearance of cultural traditions such as lithic technology, through the MSA (Mackay *et al.* 2014). Mackay *et al.* (2014) propose that changes in the interaction between populations influence lithic systems, the complexity of lithic technological and other cultural traditions. This is based on the theory that larger groups retain complex traditions longer (Derex *et al.* 2013). In bigger populations, cultural knowledge is stabilized, which leads to successive improvements of this knowledge (Derex *et al.* 2013). Further, the appearance and disappearance of lithic technologies have been linked to the formation and fragmentation of social networks (Jacobs & Roberts 2009; Mackay *et al.* 2014). Four factors are used to assess the degree of interconnectedness between groups, namely provisioning systems, raw material selection, implement type, and flaking systems (Mackay *et al.* 2014).

Provisioning systems: Mackay *et al.* (2014) use provisioning systems adapted from Kuhn (1995), these include place and individual provisioning systems. Place provisioning is the transportation of raw material to a location allocated to knapping (Parry & Kelly 1987) and is employed in environments associated with the availability of predictable resources (Kuhn 1995). Predictability of resources is also associated with extended occupancy and less mobility (Kuhn 1995; Mackay *et al.* 2014). In contrast to this system, is the individual provisioning system (Binford 1979; Kuhn 1995). This system is associated with an environment where resources are unpredictable and thus tools are transported, maintained, and often have multiple uses (Clarkson 2004). This system is also associated with longer travel times and thus greater mobility (Clarkson 2004). These two systems depend on different levels of resource availability along with different environments and are most efficient in their respected environment (Mackay *et al.* 2014). With this taken into account, it is hypothesized that the information transfer of utilization of various raw materials will be restricted to environments with underlying geological similarities (Mackay *et al.* 2014). The Howiesons Poort is one of the techno-complexes displaying significant similarities in flaking systems and implement form, but raw materials vary according to local rock types (Wurz 2002; Minichillo & Ambrose 2006).

Raw material: The raw material used can restrict what is made and its ability to be re-used (Goodyear 1989; Eren *et al.* 2011). The material used can influence the transfer of knowledge, as the success of some flaking systems depends on a specific rock type (Mackay *et al.* 2014).

Implement type: Implement types are explained by Mackay *et al.* (2014) as morphologically similar retouched artefacts mostly made from blades or flakes. The process of copying an implement type is much simpler than learning a flaking system as only the end-product is needed for information transfer and not necessarily extensive interaction between groups (Högberg & Larsson 2011). Mackay *et al.* (2014) propose that similarities limited to implement type may point to weakly connected groups.

Flaking systems: Flaking systems refers to the strategy in which cores are reduced (Mackay *et al.* 2014). Learning a flaking system is referred to as process copying (Derex *et al.* 2013). This requires extensive interaction and has been compared to an apprenticeship (Stout 2002; Tostevin 2012). Consequently, it is hypothesized that similarities in flaking systems suggest prolonged interaction (Mackay *et al.* 2014).

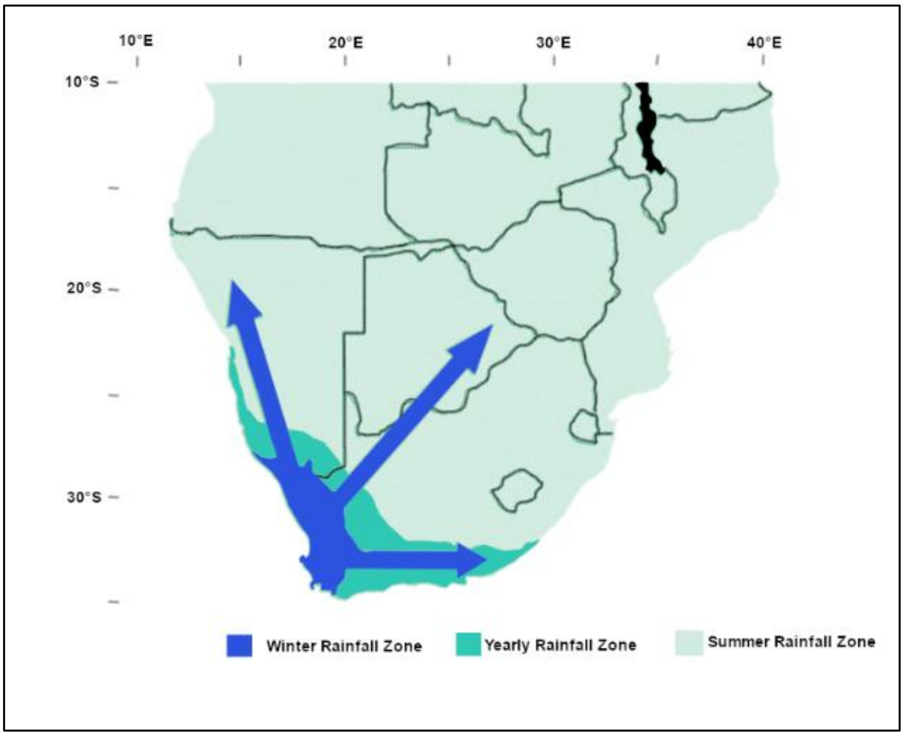

FIGURE 2.4: MAP ADAPTED FROM CHASE & MEADOWS (2007) SHOWING DIFFERENT RAINFALL ZONES.

Mackay *et al.* (2014) uses these 4 factors to compare assemblages within (intra) and between (inter) regions. They use three regions, summer rainfall zone (SRZ), winter rainfall zone (WRZ), and yearly rainfall zone (YRZ) (Fig. 2.4). These zones were defined based on precipitation per season (Chase & Meadows 2007, Roffe *et al.* 2019). Modern rainfall zones are used as there is insufficient evidence to predict the extent and shift of these zones during specific MIS periods (Mackay *et al.* 2014; Roffe *et al.* 2019). Chase and Meadows (2007) also note that the extent and conditions of these rainfall zones did not stay constant during the MIS 5. Mackay *et al.* (2014) assess assemblages from the three different regions during the MIS 5-MIS 2 periods to investigate the correlation between lithic variation, environmental factors, and interaction between groups at a specific time. Using the four factors identified by Mackay *et al.* (2014) the following critically assesses the authors' conclusions on interaction during MIS 5.

2.3.2.3 The interconnectedness of MIS5 peoples in South Africa.

Winter Rainfall Zone (WRZ)

*Raw Material***:** Most WRZ assemblages are dominated by local raw material this includes DRS (Porraz *et al.* 2013), EBC (Schmid *et al.* 2016), YF (Wurz 2012), HDP1 (Will *et al.* 2013), KFR (Schmid *et al.* 2016), AXI (Vogelsang *et al.* 2010) and SH (Volman 1978).

*Provisioning system***:** Place provisioning seems to be present at all WRZ sites. The WRZ sites of DRS (Porraz *et al.* 2013), EBC (Schmid *et al.* 2016), YF (Wurz 2012), HDP1 (Will *et al.* 2013), KFR (Schmid *et al.* 2016), show on-site reduction with the entire reduction sequence present. AXI (Vogelsang *et al.* 2010) and SH (Volman 1978) are exceptions. While later reduction phases are still present, the assemblages of both these sites show that some initial reduction probably happened somewhere else (Volman 1978; Vogelsang *et al.* 2010). Predominant on-site reduction combined with local raw material showing dominance suggests limited mobility and thus, a place provisioning system.

*Implement type***:** Formal tools at WRZ sites include denticulates, notched pieces, and scrapers (Table 2.3). Denticulates are the primary retouch type at DRS (Porraz *et al.* 2013), EBC (Schmid *et al.* 2016), YF (Wurz 2012), HDP1 (Will *et al.* 2013), KFR (Schmid *et al.* 2016), and SH (Volman 1978). Denticulates are rare at AXI and are overshadowed by coarse edge retouch (Vogelsang *et al.* 2010).

Scrapers are also found at most sites including EBC (Schmid *et al.* 2016), YF (Wurz 2012), HDP1 (Will *et al.* 2013), AXI (Vogelsang *et al.* 2010), and SH (Volman 1978). Similarities in implement types are reported for most sites in this region. This supports Mackay *et al.* (2014) findings that the sites within the WRZ may have been loosely linked at some point during the MIS 5. However, because implement types are mostly generalized, flaking and economic systems may be better indicators of cultural transmission.

TABLE 2.3: IMPLEMENT TYPES PRESENT AT RESPECTIVE WRZ SITES

SITE	DENTICULATE	NOTCHED	SCRAPERS	UNIFACIAL POINTS	REFERENCE
HDP1	x	x	x		Will *et al.* 2013
YF	x	x	x		Wurz 2012
EBC	x		x		Schmid *et al.* 2016
DRS	x	x			Porraz *et al.* 2013
AXI	x	x	x	x	Vogelsang *et al.* 2010
SH	x		x	x	Volman 1978
KFR	x			x	Mackay *et al.* 2014; Schmid *et al.* 2016

Flaking systems within WRZ: KFR and AXI contain evidence of flaking systems matching those of MSA 2b (MSA II) (Mackay *et al.* 2014). The assemblage at AXI however, lacks convergent pieces (Vogelsang *et al.* 2010). It is suggested that DRS assemblages are much the same as the MSA II due to the production of triangular flakes and the use of Levallois centripetal core reduction (Porraz *et al.* 2013; Schmid *et al.* 2016). EBC, YF, HDP1, and SH all have flake industries and do not resemble MSA I (MSA 2A) or MSA II (MSA 2b) (Wurz 2012; Mackay *et al.* 2014). However, similarities between YF, HDP1, and SH have been noted which may signify regionalization (Volman 1978; Wurz 2012; Will *et al.* 2013; Douze *et al.* 2015). A comparative study by Schmid *et al.* (2016) states that these three sites have commonalities in their technological and economic systems. Both YF and HDP1 contain flake-based assemblages with few blades and triangular flakes and show little to no core preparation (Volman 1978; Wurz 2012; Will *et al.* 2013;

Schmid *et al.* 2016). Due to limited data on SH only typological and raw material similarities can be confirmed between the sites (Will *et al.* 2013). Mackay *et al.* (2014) did not find significant similarities in flaking systems in the WRZ concluding long intense interaction did not happen. However, the similarities between HDP1, YF, and SH and DRS, KFR, and AXI noted above might indicate substantial interaction between some sites.

Year-Round Rainfall Zone (YRZ)

Raw Material: Assemblages from CSB (Thompson & Marean 2008), DK (Thackeray 2000), PP (Schmid *et al.* 2016; Thompson *et al.* 2010), and BBC (Douze *et al.* 2015) all show that local raw material was dominantly exploited. Local raw material is also primarily found in both MSA I and MSA II assemblages from KRM (Brenner & Wurz 2019; Wurz 2013).

Provisioning system: MSA I and II assemblages from KRM (Thackeray 1989; Wurz 2002) and newly excavated MSA II assemblages from the Witness Baulk (Brenner & Wurz 2019) contain all stages of reduction. BBC (Douze *et al.* 2015), CSB (Thompson & Marean 2008), and PP (Thompson *et al.* 2010; Wilkins *et al.* 2017) also contains all stages of reduction. At DK the low percentage of cortical pieces suggests that the initial reduction of cobbles happened somewhere else but further reduction happened at the site (Thackeray 2000). Similar to the WRZ sites the use of local raw material suggests these populations did not venture far from the site. This coupled with complete reduction sequences found at the sites suggests residential occupation and place provisioning.

Implement type: Denticulates and notched artefacts are found in MIS 5 assemblages at KRM (Wurz 2002; Brenner & Wurz 2019), CSB (Thompson & Marean 2008), DK (Thackeray 2000), and BBC (Douze *et al.* 2015). As mentioned above both the MSA I and MSA II sub-stages are found at KRM. Although both KRM sub-stages contain denticulates and notched pieces, retouch is more common in MSA II assemblages (Wurz 2002; Brenner & Wurz 2019). PP13B also has two sub-stages MIS 5e -MIS 5c which is broadly contemporaneous to MSA I and MIS5b-MIS 4 which coincides with MSA II (Thompson *et al.* 2010). In both PP sub-stages, formal tools are few and general retouch dominates (Thompson *et al.* 2010). Wilkins *et al.*

(2017), in their study, of PP5-6 reported findings on MISa-d. In these sub-stages, little retouch is noted but the authors do comment on the diverse nature of tools including *pièces esquillées* and points (Wilkins *et al.* 2017). However, *pièces esquillées* might also be considered byproducts of a bipolar reduction strategy (Barham 1987). Most of these YRZ sites contain denticulates and notched pieces indicating that populations from the sites might have been loosely interacting.

Flaking systems within YRZ: Both MSA I and MSA II techno-complexes, described in section 2.3 appears at KRM and Nelson Bay cave (NBC), CSB contains an assemblage that resembles the MSA II at KRM in the aspect of unstandardized blades (Thompson & Marean 2008; Mackay *et al.* 2014). Contrary to the MSA II (MSA 2b) at KRM, more emphasis is placed on blade reduction at CSB although it also contains convergent flakes (Thompson & Marean 2008; Wurz 2013; Mackay *et al.* 2014). The definitions for CSB however, are currently too vague to make definite associations with the assemblages at KRM (Brenner & Wurz 2019).

Mackay *et al.* (2014) found that there are minor similarities in flaking systems within the YRZ indicating little coalescence during this period which is to be expected considering the time span covered by these assemblages. This is based on their findings that assemblages at the YRZ sites of BBC, PP, and DK do not entirely match either the MSA 2a (MSA I) or MSA 2b (MSA II) (Mackay *et al.* 2014). Lithic studies of DK support this as assemblages at the site are not comparable with MSA I or MSA II (Thackeray 2000). The assemblages at the site are not characterized by long flake-blades and most flake-blades are parallel rather than convergent (Thackeray 2000). However, a study by Douze *et al.* (2015) found technological similarities between BBC M3, PP 13B, and KRM MSA II. The similarities include the production of points and predetermined blanks, the use of a variety of reduction methods to produce blanks, and the dominant use of parallel core reduction methods (Douze *et al.* 2015: 25). This suggests that flaking systems within the YRZ may be more similar than concluded by Mackay *et al.* (2014) which points to greater interaction within this region during MIS 5.

Summary of Year-Round Rainfall Zone & Winter Rainfall Zone

*Raw material***:** YRZ sites and WRZ sites share the fact that raw material selection was based on availability. Sites in both regions predominantly used local raw materials.

*Provisioning systems***:** Place provision is another commonality between the WRZ and YRZ. Non-local raw materials are rare at WRZ and YRZ sites indicating limited mobility. Most sites of both regions also showed signs of on-site reduction, indicating that a place provision system was used in both regions.

*Implement type***:** The implement types from the two regions bears a resemblance. Denticulates and notched artefacts were the most common types, with few sites containing scarpers and retouched points rarely found. Thus, following Mackay et al.'s (2014) criteria, similarities in implement type indicates a weak intra-regional connection between groups in the WRZ and YRZ.

*Flaking systems***:** According to Mackay et al. (2014) flaking systems between the WRZ-YRZ did not show adequate similarities to indicate a significant interaction between these regions. However, contrary to Mackay et al. (2014) recent lithic studies of MIS 5 sites in the Western Cape show a likeness in flaking systems between the WRZ and YRZ (Douze *et al.* 2015; Schmid *et al.* 2016). As mentioned above the studies found similarities within the YRZ but further traced these similarities to some WRZ sites as well. The studies concluded that technological similarities exist between the KRM MSA II, BBC phase M3, DRS MSA Mike, and PP 13B (Douze *et al.* 2015:25; Schmid *et al.* 2016; Brenner & Wurz 2019). These four sites spanning the WRZ and YRZ have comparable core reduction methods and the assemblages all show the production of points and predetermined blanks (Douze *et al.* 2015). A comparison by Schmid et al. (2016: 185) additionally suggests that there is a unified techno-complex on a regional scale within the Western Cape which includes both WRZ and YRZ sites. Assemblages resembling the MSA II are also found at AXI and KFR. The similarities in flaking systems further support the notion that some level of interaction was present between the WRZ and YRZ during MIS 5.

Summer Rainfall Zone (SRZ)

Raw Material: SRZ raw material acquisition is dependent on local availability. The MIS 5 assemblages at SC (Schmid *et al.* 2019), RCC (Harper 1997), CoH (McNabb & Sinclair 2009), BC (Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), MC (de la Peña *et al.* 2019), BRS (Porraz *et al.* 2018; Douze *et al.* 2020), OBP (Mason 1957) and MEL (Pazan *et al.* 2020) are all dominated by raw material found locally. Most SRZ sites show notable amounts of fine-grained implements more so than is found in the YRZ and WRZ. Commonly found fine-grained materials include hornfels, chert and quartz. This may be due to the greater availability of such materials in the SRZ (Mackay *et al.* 2014)

Provisioning system: SC (Schmid *et al.* 2019), RCC (Harper 1997), CoH (McNabb & Sinclair 2009), BC (Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), MC (de la Peña *et al.* 2019) and MEL (Pazan *et al.* 2020) assemblages all show on-site reduction. Information on OBP is insufficient to make inferences about provisioning. At BRS the cores are rare, and it is suggested that cores, blanks, and tools were transported into and out of the site (Porraz *et al.* 2018). The assemblages, however, do contain evidence to suggest that some reduction happened at the site (Porraz *et al.* 2018). These sites show on-site reduction and minimal mobility inferred from the scarcity of exotic raw materials. MIS 5 SRZ sites thus present evidence that suggests place provision was employed.

Implement type: Uni- and bifacial points and scarpers are the most common implement type found at SRZ (Table 2.4). Points specifically associated with Pietersburg sites are generally unifacial and made on blades (Wadley 2015). OBP is the only site that does not have points but information on the site is rare and dates to the sixties (Mason 1957). Recent studies of MIS 5 assemblages at MEL report a small number of points but found a significant number of borers that are poorly represented at only two other SRZ sites (Pazan *et al.* 2020). Other formal tools that are also present at some sites include denticulates at CoH (McNabb & Sinclair 2009), SC (Schmid *et al.* 2019) MEL (Pazan *et al.* 2020) and MC (de la Peña *et al.* 2019), and knives at CoH (McNabb & Sinclair 2009) and RCC (Harper 1997). Douze et al. also found the presence of points at many The similarities in implement type suggest that the population in the SRZ was somewhat connected. Further, Douze et al. (2020) noted that although points from MIS 5 assemblages at BRS resemble those of other SRZ sites such as CoH, BC and MC they most closely resemble MSA II points from KRM (Douze *et al.* 2020). This might indicate some interaction between SRZ and YRZ sites.

TABLE 2.4: IMPLEMENT TYPES FOUND AT RESPECTIVE SRZ SITES

SITE	POINTS	SCRAPERS	DENTICULATES	KNIVES	BORERS	SOURCE
COH	X	X	X	X	X	McNabb & Sinclair 2009
RCC	X	X		X	X	Harper 1997
BC	X					Backwell *et al.* 2018
SC	X	X	X			Schmid *et al.* 2019
MC	X	X	X			de la Peña *et al.* 2019
OBP		X				Mason 1957
BRS	X	X				Porraz *et al.* 2018
WC	X					Beaumont & Vogel 2006
MEL	X	X	X		X	Pazan *et al.* 2020

Flaking Systems: Among the SRZ sites there is the appearance of a "techno-complex" or grouping dating to the MIS 5 referred to as the Pietersburg. Some authors propose that the Pietersburg belong to either the MSA I (Volman 1981, 1984; Lombard *et al.* 2012) or MSA II (Wadley 2015; Lombard *et al.* 2012) while others refer to it as a separate techno-complex or industry (Goodwin & van Riet Lowe 1929; Mason 1962; Sampson 1974; Grün & Beaumont 2001; Schmid *et al.* 2019). It has been suggested that the Pietersburg may represent a flaking system specifically designed for the fine-grained raw material that is locally available at most of the SRZ sites (Wadley 2015). Further suggestions have been made that the Pietersburg might be a regional expression, which seems to be confined to the interior of South Africa south of the Limpopo River (McBrearty & Brooks 2000; Wadley 2015; Schmid *et al.* 2016; Porraz *et al.* 2018) or the summer rainfall zone as described by Mackay et al. (2014).

The Pietersburg is recognized at BRS (Porraz *et al.* 2018), MC (de la Peña *et al.* 2019), OBP (Mason 1957), COH (McNabb & Sinclair 2009), WC (Beaumont & Vogel 2006), and BC (Backwell *et al.* 2018). Assemblages from these six sites all have flake industries (Mason 1957; Beaumont & Vogel 2006; McNabb & Sinclair 2009; Backwell *et al.* 2018; Porraz *et al.* 2018, de la Peña *et al.* 2019). There are further similarities in reduction method as COH (McNabb & Sinclair 2009), MC (de la Peña *et al.* 2019), BC (Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), and BRS (Porraz *et al.* 2018; Douze *et al.* 2020) contain evidence of Levallois-like strategy. de la Peña et al. (2019) also found techno-typological similarities between MC, COH, BRS, and BC in terms of triangular blanks and uni- and bifacial points. The MIS 5 at BRS further shares similarities with the MSA II found at KRM (Douze *et al.* 2020). The prominence of technological points and use of hard hammer percussion found in the MSA II at KRM largely correlates with findings of the MIS 5 layers at BRS (Douze *et al.* 2020). The MEL assemblage is not comparable to the Pietersburg, MSA I, or MSA II. However, some similarities to the Pietersburg and MSA I assemblages have been noted (Pazan *et al.* 2020). At MEL the assemblage is dominated by flakes, Levallois-like strategies are present, and points were reported, similar to most Pietersburg assemblages (Pazan *et al.* 2020). However, Levallois-like reduction is rare and only two points were found (Pazan *et al.* 2020). The assemblage at MEL was further described as “blade-rich and triangular flake-deficient” (Pazan *et al.* 2020:10) with percussion methods similar to that of MSA I (Pazan *et al.* 2020). The MEL assemblage is distinguishable from both the MSA I and Pietersburg with high proportions of retouch and borers (Pazan *et al.* 2020). RCC and SC do not have assemblages comparable to the Pietersburg. The information available on RCC is limited. However, a publication by Harper (1997) suggests that the RCC assemblage resembles MSA II based on the definition by Volman (1984). As for SC, an investigation of blade technologies of the MIS 5 concluded that the assemblage does not entirely match the MSA I, MSA II, or Pietersburg techno-complex (Schmid *et al.* 2019). SC assemblages show that a laminar reduction was used and although the assemblage is dominated by flakes it also contains a significant number of blades manufactured by the same reduction method (Schmid *et al.* 2019). Mackay et al. (2014) did not find Coherence in flaking systems within the SRZ thus concluding that there was only superficial interaction between groups within this region. However, the similarities in flaking systems between sites containing the Pietersburg indicate that some prolonged interaction might have happened in this region.

2.4 CONCLUSION.

In the first part of this section, the prevailing problems with terminology were addressed. Although terminology is essential for communication between researchers it is riddled with ambiguous definitions and conflicting solutions. Considering these obstacles surrounding the use of terminology the definitions as they will be used in this dissertation are clearly laid out in section 2.2.2. The problematic nature of terminology used in relation to the assemblages studied here is highlighted in section 2.3 where the relevant stratigraphic units for this study are discussed. Table 2.1 gives a brief look at the use of different terminology by various authors how this can lead to confusion.

Section 2.4.1 outlines the relative lack, although they seem to be increasing, of contemporary lithic studies regarding the MIS 5 and how this hampers our view of this period including cognition and regionalization. This lack of information of the MIS 5 especially in the SRZ is again picked up on in Section 2.4.2 emphasizing how this makes detailed comparative studies difficult. Nevertheless, the comparison of sites done in this section shows that across all three zones locally available raw materials were preferred and a place provisioning system was used. This suggests that populations did not travel far and that resources in all three zones were predictable at this time. There are similarities in implement types within and between the WRZ and YRZ. Denticulates and notched pieces are found at most sites in the WRZ and YRZ suggesting restricted interaction within and between these zones. However, denticulates and notched pieces might also point to similar tool use or activity patterning. This is because this implements are created through tool use rather than knapping. The majority of the sites in these zones also have flaking systems comparable to the MSA II. Once again this points to interaction between and within the WRZ and YRZ, but similarities in flaking systems, unlike implement types, suggest prolonged interaction. SRZ populations probably also had some prolonged interaction between groups as most sites have similar flaking systems linked to the Pietersburg. Most SRZ sites further contain unifacial/ bifacial points and scrapers (Table 2.4). Interestingly a significant amount of WRZ sites also contained scrapers while this implement type was not as prominent in the YRZ (Table 2.3). The flaking systems of the SRZ however are not comparable with those of the WRZ or YRZ. Thus, based on flaking system similarities some prolonged interaction between groups happened within the YRZ, WRZ, and SRZ. This type of interaction also happened between the WRZ and YRZ but not between the SRZ and either of the other zones.

Following the Mackay et al. (2014) criteria regionalization is expected to be more prominent in times when the interaction between groups was superficial or when populations were fragmented. The information discussed above shows that during MIS 5 interaction between the SRZ and either of the other zones was arguably minimal, and these populations fragmented. This leads to the conclusion that regionalization is expected between the YRZ and SRZ. Thus, differences are expected between the CoH a SRZ site and KRM a YRZ site. At the moment Pietersburg and MSA I and MSA II are interpreted in a different context largely due to the geographical space separating them. It is also difficult to compare these entities because of the lack of information available on MIS 5 sites in the SRZ and the disjunctive nature of studies done by different people. This study will thus use the same methods to technologically examine the Pietersburg from CoH and MSA II from KRM.

Chapter 3 METHODS

This chapter serves to give more information on the materials and methods used for this study. The first section will provide detailed information on the two samples analysed here. The second section will explain the methods used to technologically analyse the lithics from the two relevant samples.

3.1 SAMPLE

This study compared two MIS 5 assemblages. The MSA II assemblage came from Klasies River Main site (KRM) from layer BOSThree that was excavated by Wurz between 2015 – 2020 (Fig. 3.1). The squares analysed from this layer included squares C2-3 and B1-3 (Fig. 3.2). Square C1 was not part of this analysis as has already been analysed (Brenner *et al.* 2020). Squares A1-3 were also not part of this study because they are being curated. The sample consisted out of 20929 pieces not analysed before. This collection is currently in temporary storage in the Origins Centre, Wurz laboratory. This was compared with a Pietersburg sample from Bed 5/ Stratigraphic unit 6 (120-132 inches below datum) from Cave of Hearths (CoH) (Fig. 3.3 & 3.4). The Pietersburg sample was excavated by Mason between 1953 – 1954 and also reported on by (McNabb & Sinclair 2009). The sample analysed consisted of 780 pieces that were located in the Wits collections in the Origins Museums. The curator, Dr Russell facilitated access to this collection.

The density of artefacts was calculated per litre after Wadley et al. (2016). This was done by dividing the total number of lithics with litres of sediment excavated for squares B1-3 and C2-3. In Table 3.1 the lithic density for artefacts both grater and smaller than 2cm were calculated. The same calculations for CoH could not be done as the volume of excavated material and small debitage was unavailable.

Table 3.1: Volume of deposits and lithic density per litre for BOSThree squares B1-3 and C2-3

	Volume of deposits (m^3)	***Lithic artefacts*** (n)	***Density (artefacts per litre)***
BOSThree total lithic artefacts	0,15	19665	131
Artefacts > 2cm	0,15	534	4
Artefacts < 2cm	0,15	19131	127

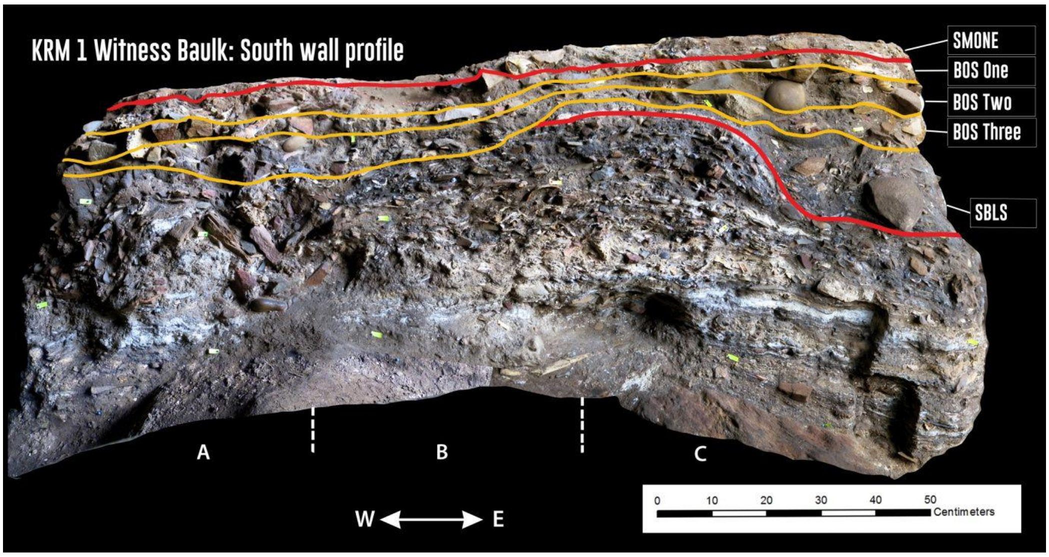

Figure 3.1: Southern profile of the witness bulk indicating the relevant layers (Brenner *et al.* 2020).

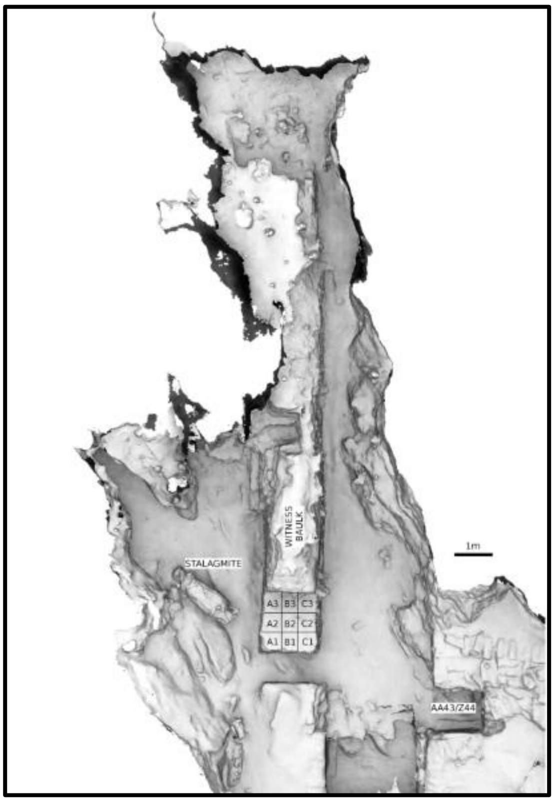

FIGURE 3.2: 3D MODEL OF CAVE 1 AT KLASIES RIVER MAIN SITE, SHOWING THE LOCATION OF THE WITNESS BAULK WHERE THE SAMPLE FOR THIS PROJECT WAS EXCAVATED (BRENNER & WURZ 2019).

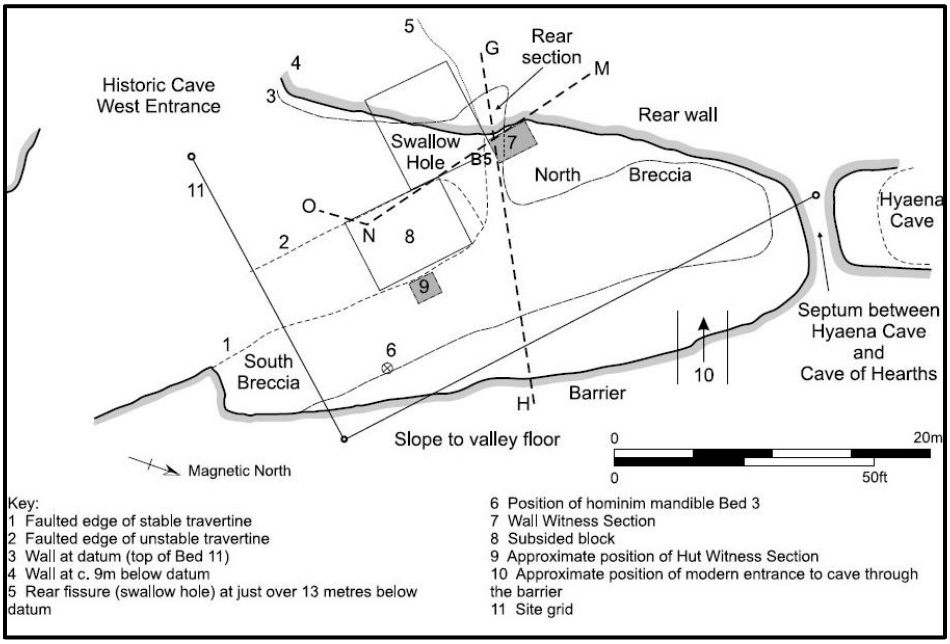

FIGURE 3.3: CAVE OF HEARTHS LAYOUT WITH B5 INDICATING THE APPROXIMATE LOCATION OF BED 5 EXCAVATIONS BY MASON IN 1953 (MCNABB & SINCLAIR 2009).

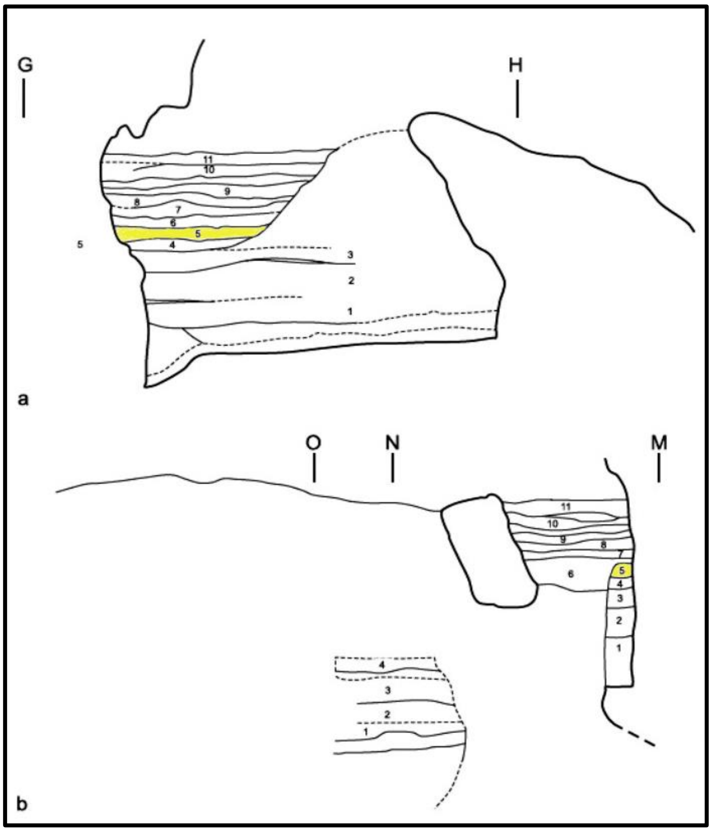

Figure 3.4: Beds of CoH with Bed 5 highlighted in yellow.

3.2 Technological analysis

The technological study done for this project highlighted the whole process of making stone tools. Technological studies see lithic tools as the result of a complex chain of actions (Andrefsky 2008). In this chain, the techniques used are studied and placed in chronological order to determine the method (Tixier 2012:132). For this technological study, the *chaîne opératoire* approach was chosen which studies all processes involved in making stone tools from raw material collection to discarding the tool (Inizan *et al.* 1999). This approach aims to reconstruct the organisation of technological systems at a particular site (Sellet 1993). Both the samples from KRM and COH were technologically studied using attributes derived from Villa et al. (2010), Tostevin (2012), Pargeter (2016), Douze et al. (2018) and Brenner & Wurz (2019) (Appendix A; Table A1).

Middle Stone Age technological studies in South Africa incorporate pieces larger than 20 mm for technological analysis (Porraz *et al.* 2013; Soriano *et al.* 2015; de la Peña & Wadley 2017; Bader *et al.* 2018; Douze *et al.* 2018; Brenner & Wurz 2019). However, this results in the loss of evidence for lithic miniaturization (Pargeter & Shea 2019). Lithic miniaturization is defined by Pargeter (2016: 221) as “the systematic production and use of small tools from small cores”. Pargeter & Shea (2019) state that miniaturization is already evident in the MSA. This phenomenon is linked to important evolutionary topics including “modern human behaviour” (Pargeter & Shea 2019). Because there are few technological studies including lithics smaller than 20mm there is a lack of information regarding lithic miniaturization (Pargeter & Shea 2019). However, because there were no pieces under 2 cm in the assemblage from CoH that could be located only ≥2cm and bladelets of BOSThree (KRM) were technologically analysed.

All pieces were washed and separated into basic categories adopted from Inizan et al. (1999) before the technological analysis began. The categories for this technological analysis included all cores, bladelets (<12mm in width, Tixier 1974) and blanks. Blanks refer to all retouched and unretouched flakes and proximal pieces >2cm (after Roth & Dibble 1998). In this study, this included all types of flakes, blades, bladelets and points and preparational pieces. However, Roth and Dibble (1998) included such pieces >3cm in the blank category, whereas this study focusses on pieces >2cm. The small debitage (flake fragments <2cm excluding bladelets) and non-lithics were counted. Blades and flakes were identified based on their length to width ratio. An artefact was termed a flake if it possessed a striking platform, recognizable dorsal and ventral surfaces and a length to width ratio of less than 2:1 (Crabtree 1972; Inizan *et al.* 1999; Shea 2020). If an artefact had the previously mentioned attributes but had a length at least twice that of its width it was termed a blade (Crabtree 1972; Shea 2020). Bladelets had similar characteristics as blades but had a width of less than 12mm (Tixier 1974). Artefacts were classified as points based on the following morphological features; the artefact had convergent lateral edges that join in the distal part and geometrically resembled a triangle (Douze *et al.* 2020). The points were further separated into three categories according to Brenner & Wurz (2019). Type 1 is symmetric/asymmetric flake sized points with convergent lateral edges. Type 2 is defined as convergent pieces with blade dimensions. Type 3 is pieces with mostly parallel lateral edges but a pointed proximal end. The pieces in each category were separated into raw material categories then counted and weighed. Those pieces further analysed were measured with a calliper using the maximum dimensions of the lithic (Andrefsky 2008). Measurements were only taken if that dimension was still intact.

3.2.1 Raw material

Analysis of raw materials is an important stage of the *chaîne opératoire* because of the information the analysis of raw material ratios can yield. Raw material selection can influence the knapping technique used (de la Peña 2015; Delagnes *et al.* 2016), shed light on migration/mobility patterns (Soriano *et al.* 2007) and symbolic actions (Lewis-Williams & Pearce 2006. It provides information on exchange networks (Brooks *et al.* 2018) in for example the East African Middle Stone Age, and it is also one of the criteria used to assess the presence of regionalization, as discussed in Chapter 2. For this comparative study, the selection of raw material was compared. The raw material classification was done by the naked eye without the aid of a petrographer and was subjectively based on texture, presence and size of crystals, foliation and cleavage. However, the author acknowledges that it is very difficult to distinguish fine-grained black materials from each other without the help of a petrographer. The following categories were used; quartzite, chert, milky quartz, hornfels, basalt, fine-grained dark material (FGD) for the COH assemblage, and indeterminate. The fine-grained dark material ranges from dark black to dark brown in colour and can be shale, slate, fine-grained hornfels or fine-grained basalt. This study further differentiated between fine-grained, medium-grained and coarse-rained quartzite.

3.2.2 Technique & method

To compare the techniques and methods of the assemblages technological attributes were used to describe cores, blanks and formal tools. Technique is the technical action used to modify stone (Shea 2020). Understanding the technique and technical actions used is important to investigate the associated core reduction technologies (Knippenberg 2007).

To infer the technique used several physical characteristics were analysed such as profile descriptions, platform characteristics and negative bulb scars on cores (Appendix A; Table A1). Platforms and platform characteristics were recorded in detail as these traits are also related to the percussion technique (Andrefsky 2008). The platform characteristics that were recorded consisted out of bulb description, presence of platform, type of platform and type of platform preparation (Appendix A; Table A1). The combination of lipping, bulb and platform preparation often denotes a specific percussion technique (Andrefsky 2008). Platform preparation along with platform type can also be used to study the objective of the knapper and percussion technique (Inizan *et al.* 1999; Andrefsky 2008). Although these physical aspects can be used to infer percussion techniques, the characteristics might present differently in various raw materials. The preferred way to analyse techniques is to do experimental studies on the specific raw material the lithics being analysed is made of (Tixier 2012). Although preferred methods exist, some extent of equifinality should be expected in morphological studies (Bar-Yosef & van Peer 2009) as different reduction methods can lead to the same shapes. The reconstruction of the techniques/technical actions used also reveal the associated methods (Tixier 2012).

Method is defined here as the organization of techniques in different carefully thought-out sequences according to Tixier (2012:42) and Shea (2020:121). Technological types of blanks can produce information regarding method and technique (Bar-Yosef *et al.* 2009; Douze *et al.* 2015). Negatives on blanks were analysed to determine technological types (Appendix A; Table A1), including unidirectional, bidirectional, crossed, centripetal, core management and débordant types. The technological type category débordant (Soriano *et al.* 2007; Charrié-Duhaut *et al.* 2013; Porraz *et al.* 2013; Douze *et al.* 2015), was used to describe a core edge piece and was considered part of core maintenance activities. Cores are also used to infer method.

Geometric attributes including profile and cross-section were also recorded. Tostevin (2012) explains that the geometric profiles can be used to look at the use of ridge systems, preferred shape of core surface and the use of *nervures guides*.

Nervures guides are the interaction of previous flake scars on the current flake morphology (Tostevin 2012). These attributes can give more information on the reduction sequences.

The core type can give useful information regarding the approach used to exploit the core (Wurz 2013). The cores were studied using attributes from various studies (Debènath & Dibble 1994; Inizan *et al.* 1999; Conard *et al.* 2004; Brenner & Wurz 2019; Shea 2020). The cores were categorised into 3 blank types, cobbles, pebbles (smaller than 64mm; Wentworth 1922) and angular blocks. The length (longest axis), width (longest dimension perpendicular to length) and thickness (maximum dimension perpendicular to the intersection of the length and breadth dimensions) of all cores were measured (Shea 2020). The amount of cortex present on cores was also recorded in percentage. This in combination with cortical pieces is an important part of the reduction sequence which may shed light on differences in technology used (Brenner & Wurz 2019). The number of worked surfaces, scars per surface and nature of scars was catalogued (Appendix A; Table A1). The smaller scars, typically smaller than 3mm in maximum dimension near the platforms were not counted. In theory, the number of scars should indicate the extent to which the core was reduced although this is dependent on the reduction technique used (Shea 2020). All of these aspects help to infer the reduction method used, which in turn is used in the technological classification of the techno-complex (Moore & Preston 2016). As mentioned in Chapter 2 assemblages belonging to the same techno-complex have similar flaking systems and implement types. Thus, comparing reduction methods can help investigate similarities between assemblages and assess if they belong to the same techno-complex. A list of relevant core types was constructed following definitions used by Debènath & Dibble (1994), Inizan et al. (1999), Conard et al. (2004), Brenner & Wurz (2019) and Shea (2020) (Table 3.2). Descriptions of the main core types used in this study follow below.

TABLE 3.2: CORE CATEGORIES USED.

CORE TYPES
Levallois preform flake
Levallois preform point
Levallois recurrent centripetal
Levallois recurrent uni-bidirectional
Blade bidirectional
Discoid unifacial
Discoid bifacial
Core fragment
Informal core
Platform core
Double Platform core

Levallois cores

There are two main *Levallois* methods. The first is a method used to remove a preferential flake, blade, or point. This results in a core that has two asymmetrical surfaces. One surface is used to remove the *Levallois* products also referred to as the debitage surface. The *Levallois* product removed usually spans most of the debitage surface (Inizan *et al.* 1999). The other surface is used as the striking platform and does not necessarily need preparation. These two surfaces are not interchangeable. The result is a core with one organised debitage surface often showing a large flake scar where the final *Levallois* product was removed. The second surface is less organised and, in most cases, more domed in form (Inizan *et al.* 1999). The specific name for the *Levallois* core is determined by the final removal i.e. if the final removal is a point the core will be named a *Levallois* preform point core (Debènath & Dibble 1994; Inizan *et al.* 1999).

The second method is for the removal of several *Levallois* products referred to as the recurrent *Levallois* method. In this method, the debitage surface is intended to yield several *Levallois* products instead of just one (Inizan *et al.* 1999). This can be done in a centripetal fashion where the entire surface is used as a striking platform (Inizan *et al.* 1999). This can also be done in a unidirectional manner where flakes are removed from a single direction or in a bidirectional manner where flakes originate from opposing sides (Inizan *et al.* 1999). The morphology of each *Levallois* product is determined by the previous removal resulting in several products with different morphologies (Boëda 1995; Inizan *et al.* 1999).

Discoid cores

Discoid cores have a circular circumference with two surfaces. One surface, usually the less convex one, is the debitage surface showing the removal of flakes centripetally (Inizan *et al.* 1999). The other surface shows negative scars of platform preparation (Inizan *et al.* 1999). The surfaces can also be used alternately as the debitage and striking surface resulting in discoid biface cores (Shea 2020).

Blade cores

Blade cores show evidence of the hierarchical removal of elongated products suggesting the repeated removal of blades (Shea 2020). This can be done in a unifacial or bifacial manner.

Platform cores

Platform cores show the recurrent removal of predetermined products from one or more platforms (Conard *et al.* 2004; Brenner & Wurz 2019; Shea 2020). This core has one or more well developed striking platforms (Conard *et al.* 2004).

Informal cores

Informal cores show the removal of products in an unorganised or opportunistic manner.

Indeterminate cores

These cores cannot confidently be placed into a formal core type because it is broken or lacks sufficient morphological aspects (Conard *et al.* 2004).

3.2.3 Tool production & utilization

For this study, tools are recognized as artefacts that have been intentionally modified for use or show use-wear (Andrefsky 2008). An artefact can thus be described as a tool regardless of its function. Further, formal tools are defined as tools that show extra effort in their production to modify their sharpness and or shape (Andrefsky 2008). Retouched implements were divided into the following categories based on the type of retouch present, scraper, notched tool, denticulate tool, unifacial points and bifacial points. Porraz et al. (2015) make a distinction between uni/bifacially retouched and shaped points based on the invasiveness of retouch. For this study points with uni/bifacial retouch and shaping was referred to simply as unifacial or bifacial points. However, the extent of retouch was noted on points and other blank types after Inizan et al. (1999). Laterally retouched pieces were also identified under 10X magnification. Lateral retouch is classified here as continuous short retouch (Douze *et al.* 2015). The position and type of retouch were recorded after Inizan et al. (1999). The retouch position was of interest as the position of retouch varies throughout especially the Pietersburg (Mason 1957) as well as in the KRM layers (Brenner & Wurz 2019). The retouch position was recorded using appendix A, figure (A1). Edge damaged pieces were pieces with edge modification of irregular shape and distribution (Brenner & Wurz 2019). This was also identified using 10X magnification and recorded using appendix A (Fig. A1). It should be noted that the presence of edge damage might indicate modification due to post-depositional processes or utilization (Douze *et al.* 2015).

Chapter 4 Results

4.1 Results of Bed 5, CoH

4.1.1 Assemblage composition

The total number of lithics analysed from the CoH Bed 5 was 780. This includes all pieces >2 cm as well as bladelets and retouched fragments that were <2 cm that could be located for Bed 5/ Stratigraphic unit 6. However, there was no small debitage in the stored assemblage that could be located. This sample was dominated by points (Table 4.1) which made up 35,6% of the assemblage. A significant number of flakes was also present contributing 35,4%. The remainder of the sample consisted of cores (5,3%), blades (10,3%) and a hammerstone.

Table 4.1: Assemblage composition of Bed 5.

		CORES	FRAGMENTS	BLADES	FLAKES	POINTS	HAMMER-STONES	TOTAL
INDURATED SHALE	N	-	4	6	5	16	-	31
	%	-	3,8	7,5	1,8	5,8	-	4
QUARTZITE	N	15	42	32	111	122	1	323
	%	36,6	40,4	40	40,2	43,9	100	41,4
HORNFELS	N	3	6	7	23	20	-	59
	%	7,3	5,8	8,8	8,3	7,2	-	7,6
CHERT	N	6	9	11	38	48	-	112
	%	14,6	8,7	13,8	13,8	17,3	-	14,4
MILKY QUARTZ	N	15	26	10	54	14	-	119
	%	36,6	25	12,5	19,6	5	-	15,3
FINE-GRAINED DARK MATERIAL	N	2	16	13	44	56	-	131
	%	4,9	15,4	16,3	15,9	20,1	-	16,8
INDETERMINATE	N	-	1	1	1	2	-	5
	%	-	1	1,3	0,4	0,7	-	0,6
TOTAL	N	41	104	80	276	278	1	780
	%	5,3	13,3	10,3	35,4	35,6	0,1	100
	g	2856	3730	2387	6146	4760	356	20235

4.1.2 Raw material

Quartzite (41,4%) is the dominant raw material in this assemblage (Table 4.1). The assemblage also has significant amounts of chert, milky quartz and fine-grained dark material. The preferred raw material for points, flakes and blades was quartzite (Table 4.1). Interestingly, only 5% of the points were made on milky quartz while this material has much higher percentages in all other categories (Table 4.1).

4.1.3 Technique & method

There is no obvious difference of platform characteristic between blades, points and flakes. In all three blank types, most pieces show no platform preparation, plain platforms, no lipping and visible bulbs of percussion (Table 4.3). The scarcity of lipping and platform preparation combined with relatively large platforms suggests that direct hard hammer percussion was used (Inizan *et al.* 1999). On the other hand, direct hard hammer percussion is usually accompanied by prominent bulbs (Inizan *et al.* 1999). Although many of the pieces had visible bulbs of percussion most of these bulbs were not pronounced as is common for hard hammer percussion. A visible bulb refers to a bulb that is visible to the naked eye and is clearly distinguishable but not pronounced. A similar category termed medium bulb has been used by Banks et al. (1996) and Galili et al. (2018).

Table 4.2: Platform and bulb characteristics according to different blanks types of Bed 5.

Platform characteristics

Blades (N=80)			Flakes (N=276)			Points (N=278)		
Platform Preparation			**Platform Preparation**			**Platform Preparation**		
	N	**%**		**N**	**%**		**N**	**%**
Indeterminate	9	11,7	Indeterminate	4	1,4	Indeterminate	16	5,8
No preparation	62	80,5	No preparation	235	85,1	No preparation	219	78,8
Trimming	9	11,7	Trimming	34	12,3	Trimming	42	15,1
Abraded	0	0,0	Abraded	3	1,1	Abraded	1	0,4
Platform Type			**Platform Type**			**Platform Type**		
	N	**%**		**N**	**%**		**N**	**%**
Plain	53	66,3	Plain	188	68,1	Plain	177	63,7
Faceted	9	11,3	Faceted	51	18,5	Faceted	57	20,5
Punctiform	1	1,3	Punctiform	6	2,2	Punctiform	5	1,8
Linear	3	3,8	Linear	5	1,8	Linear	4	1,4
Broken	2	2,5	Broken	5	1,8	Broken	3	1,1
Dihedral	4	5,0	Dihedral	15	5,4	Dihedral	16	5,8
Indeterminate	8	10,0	Indeterminate	6	2,2	Indeterminate	16	5,8
Bulb of Percussion			**Bulb of Percussion**			**Bulb of Percussion**		
	N	**%**		**N**	**%**		**N**	**%**
Visible Bulb	38	47,5	Visible Bulb	145	52,5	Visible Bulb	141	50,7
No Bulb	18	22,5	No Bulb	32	11,6	No Bulb	14	5,0
Prominent	17	21,3	Prominent	96	34,8	Prominent	107	38,5
Indeterminate	7	8,8	Indeterminate	3	1,1	Indeterminate	16	5,8
Lipping			**Lipping**			**Lipping**		
	N	**%**		**N**	**%**		**N**	**%**
Yes	4	5,0	Yes	10	3,6	Yes	12	4,3
No	67	83,8	No	262	94,9	No	250	89,9
Indeterminate	9	11,3	Indeterminate	4	1,4	Indeterminate	16	5,8

Of the flakes 41 (14,8%) were classified as core management flakes, these included 4 (1,4%) débordants (Table 4.2). The blades also had one core management piece and 8 (10%) débordant blades. Most flakes were indeterminate (n=114, 41,3%) and the next most numerous technological category is unidirectionally scarred flakes (n=54, 19,6%). Most of the blades (n=35, 43,8%), and points (n=161, 57,9%) have a unidirectional pattern. No crests were found in this assemblage. The relatively few crossed and centripetal negatives on blanks support the idea of a multidirectional reduction strategy. Centripetal dorsal scar patterns have been associated with Levallois and Discoid reduction methods (Inizan *et al.* 1999), but no discoidal cores were identified in this study (see section 1.4.3.1 below).

Table 4.3: Summary of the technological analysis of Bed 5.

		N	%
FLAKES (276)	Unidirectional	54	19,6
	Bidirectional	36	13,0
	Indeterminate	114	41,3
	Core Management	37	13,4
	Débordant	4	1,4
	Crossed	13	4,7
	Crested	-	-
	Centripetal	18	6,5
BLADES (80)	Unidirectional	35	43,8
	Bidirectional	18	22,5
	Indeterminate	16	20,0
	Core Management	1	1,3
	Débordant	8	10,0
	Crossed	1	1,3
	Crested	-	-
	Centripetal	1	1,3
POINTS (278)	Unidirectional	161	57,9
	Bidirectional	26	9,4
	Indeterminate	76	27,3
	Core Management	-	-
	Débordant	-	-
	Crossed	14	5,0
	Crested	-	-
	Centripetal	1	0,4
	Type 1	172	61,9
	Type 2	70	25,2
	Type 3	39	14,0

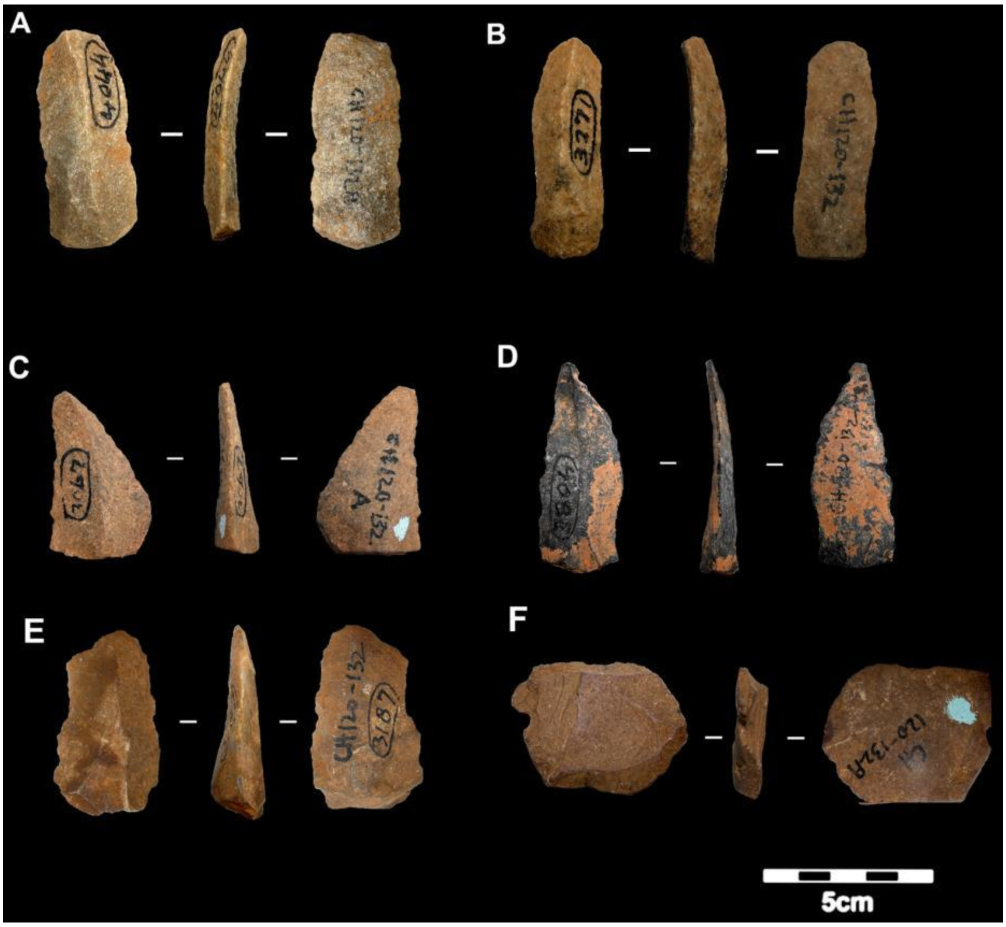

Figure 4.1: A) Unidirectional blades in quartzite, B) Unidirectional blade in quartzite C) Point type 1 in quartzite, D) Point type 2 in hornfels, E) Unidirectional Flake in chert, F) Indeterminate Flake in FGD.

This assemblage mostly consisted out of points which contributed 35,6% (n=278). The points were divided into three types following Brenner & Wurz (2019) as discussed in Chapter 3. Type 1 was the most common (61,9%) Type 2 was also common and 25,2% fell into this category. Type 3 was least common in this assemblage (14,0%). There were also a number of unifacial points (n= 20) that will be discussed in the retouch and tool section (section 4.1.4). The flakes had primarily triangular cross-sections and straight profiles (Table 4.4). The point frequencies were very similar to the flakes which contributed 35,4% (n=276). The blades which were the minority in this assemblage had similar cross-sections and profiles to the flakes and points (Table 4.4).

If the data from the three blank categories are considered the reduction method was aimed at producing points with pronounced ridges. Triangular cross-sections dominated across all categories suggestion one ridge was used as a *Nervures guides* (Tixier 2012).

Table 4.4: Geometric attributes according to different blank types of Bed 5.

Geometric attributes

Blades (N=80)			**Flakes (N=276)**			**Points (N=277)**		
Cross-section			**Cross-section**			**Cross-section**		
	N	**%**		**N**	**%**		**N**	**%**
Triangular	36	45,0	Triangular	41	14,9	Triangular	115	41,4
Trapezoidal	13	16,3	Trapezoidal	25	9,1	Trapezoidal	33	11,9
Flat	4	5,0	Flat	34	12,3	Flat	15	5,4
Triangular/ Trapezoidal	2	2,5	Triangular/ Trapezoidal	6	2,2	Triangular/ Trapezoidal	32	11,5
Indeterminate	25	31,3	Indeterminate	170	61,6	Indeterminate	83	29,9
Profile			**Profile**			**Profile**		
	N	**%**		**N**	**%**		**N**	**%**
Straight	51	63,8	Straight	212	76,8	Straight	211	75,9
Twisted	12	15,0	Twisted	23	8,3	Twisted	2	0,7
Curved	17	21,3	Curved	40	14,5	Curved	48	17,3
Indeterminate	0	0,0	Indeterminate	1	0,4	Indeterminate	17	6,1

In this assemblage blades were the longest (61,9mm) and thinnest (10,5mm) based on the mean length (Table 4.5). The blade thickness was significantly different from that of the flakes (11,8mm), according to the results of the Mann-Whitney U test (Mann & Whitney 1947) (Appendix A; Table A2). The lengths and thickness of the blades were also significantly different from the corresponding values of the flakes and points. Based on the mean values, the blades further had the smallest platform width (19,2mm), thinnest platform (9mm), and the largest length to platform width ratio (7,5mm) (Table 4.5). Significant differences were found between the blades and both other blank types in the platform width and platform thickness to length ratio categories (Appendix A; Table A2). Based on this the dimensions of the blades were clearly different from both the flakes and the points. Table 4.5 shows a notable difference between the point and flake lengths and Mann-Whitney U test confirmed that this difference is significant (Appendix A; Table A2). The Mann-Whitney U test also revealed that no significant difference was found between the flakes and points based on the thickness, width, platform width or platform thickness (Appendix A; Table A2). This data seems to indicate that the points were most similar to the flake dimensions while blades were the outlier. Most of the blanks were longer than any of the cores suggesting a long reduction sequence (Table 4.5; 4.6).

TABLE 4.5: MEASUREMENTS OF ALL BLANKS OF BED 5.

	STATISTIC	FLAKES	BLADES	POINTS
LENGTH	N	270	46	205
	Max	94,6	98,9	121,9
	Min	5,8	40,5	24,4
	Mean	46,9	61,9	56,5
	CV	33,6	24,7	28,7
	SD	15,8	15,3	16,2
WIDTH	N	277	77	281
	Max	74,2	48,13	83,2
	Min	6,9	14,1	10,5
	Mean	35,5	26	31,2
	CV	30,1	29,1	30,1
	SD	10,3	7,6	9,4
THICKNESS	N	277	77	281
	Max	27,5	24,2	25,3
	Min	3,2	3,9	3,6
	Mean	11,8	10,5	11,4
	CV	33,1	38,9	32,4
	SD	3,8	4,1	3,7
PLATFORM WIDTH	N	332	66	267
	Max	67,7	33,4	66
	Min	5,1	3,7	6,5
	Mean	26,3	19,2	26
	CV	37,8	36	33,5
	SD	9,8	6,9	8,7
PLATFORM THICKNESS	N	332	69	266
	Max	25,4	20,01	34,1
	Min	1,09	2,41	1,5
	Mean	10,2	9	10,6
	CV	38,6	43,7	39,7
	SD	3,8	3,9	4,2
PLATFORM THICKNESS: LENGTH RATIO	N	243	45	205
	Max	39,8	3,7	25,4
	Min	1,7	19,6	1,2
	Mean	5,6	7,5	5,9
	CV	66,5	40,2	52,6
	SD	3,72	3,01	3,11

4.1.3.1 Cores

There was a scarcity of cortical pieces in Bed 5 which made up only 3,8% (n=30) and most (2,1%, n=16) of the cortical pieces came from the cores. The lack of cortical pieces might be because raw materials were available in the forms of outcrops, very large boulders and slabs. Pieces of raw materials thus had to be removed from the source, possibly with hard hammer percussion (McNabb & Sinclair 2009). This differs from cobbles that can be transported entirely to the site. Quartzite was also locally available in the form of cobbles found at the Mwaridzi river directly below CoH. The small number of cortical pieces might also indicate that some initial reduction happened off-site.

The blank type of most cores was unknown. This is because only a few cores (n= 16, 40%) retained cortex that give information about the blank type. Four cores were made on angular block blanks, two on pebbles and three on cobbles. There were 41 cores in this assemblage, and they were classified into platform (n=7, 17,1%), Levallois (n=13, 31,7%), informal (n=11, 26,8%), hybrid platform/Levallois (n=2, 4,9%), indeterminate (n=8, 19,5%) (Table 4.6).

TABLE 4.6: CORE TYPES AND MEASUREMENTS OF BED 5.

CORE TYPE	N	%	AVERAGE SCAR SIZE (MM)	AVERAGE LENGTH (MM)	AVERAGE WIDTH (MM)	AVERAGE THICKNESS (MM)	AVERAGE WEIGHT (G)
PLATFORM	7	17,1	24	46,8	44,7	31,2	78,1
LEVALLOIS	13	31,7	20,1	48,6	45,7	22,1	55,1
INFORMAL	11	26,8	23,1	47,3	42,1	23,9	58,4
INDETERMINATE	8	19,5	22,6	36,5	34,8	24,4	34,2
HYBRID	2	4,9	25,7	55	57,6	22,8	88,5
MEAN	-	-	22,6	46,4	43,4	24,6	58,6
SD	-	-	8,8	13,7	10,7	7,5	38,1
TOTAL	41	100	22,3	46,4	43,4	24,6	58,6

The Levallois cores at 13 (31,7%) were the most common formal core type and were of the Levallois preferential flake (LPF) type (Fig. 4.2 A). The LPF cores generally had an organised and unorganised surface with one large preferential flake taken from the organised surface. In most cases, the unorganised surface was slightly domed. The cores classified as informal cores (n=11, 26,8%) did not exhibit an organised reduction sequence but were rather exploited in an opportunistic manner (Fig. 4.2 B). All but one informal core had flake sized scars exclusively. The indeterminate cores were all made on milky quartz and were very exhausted, making it difficult to determine the reduction method as well as distinguish scars (Fig. 4.3 A). There were also two cores classified as hybrid Levallois/platform cores (n=2). These cores exhibited both platform and Levallois characteristics (Fig. 4.3 B). Both cores classified as hybrid Levallois/platform cores had one platform and had irregular flake sized scars. The final category was platform cores. All of the seven platform cores had a single platform. The platform cores further had irregular flake sized scar patterns (Fig. 4.4). There were two platform cores with both flake and elongated blade sized scars

The platform and Levallois categories made up most of the core types and the majority of cores had only flake scars. The few cores that exhibited blade scars only had one or two elongated scars. All cores were relatively small in size. The average scar size of the cores (22,3 mm) was smaller than the average blade, flake and point lengths (Table 4.5; 4.6). This points to a long reduction sequence.

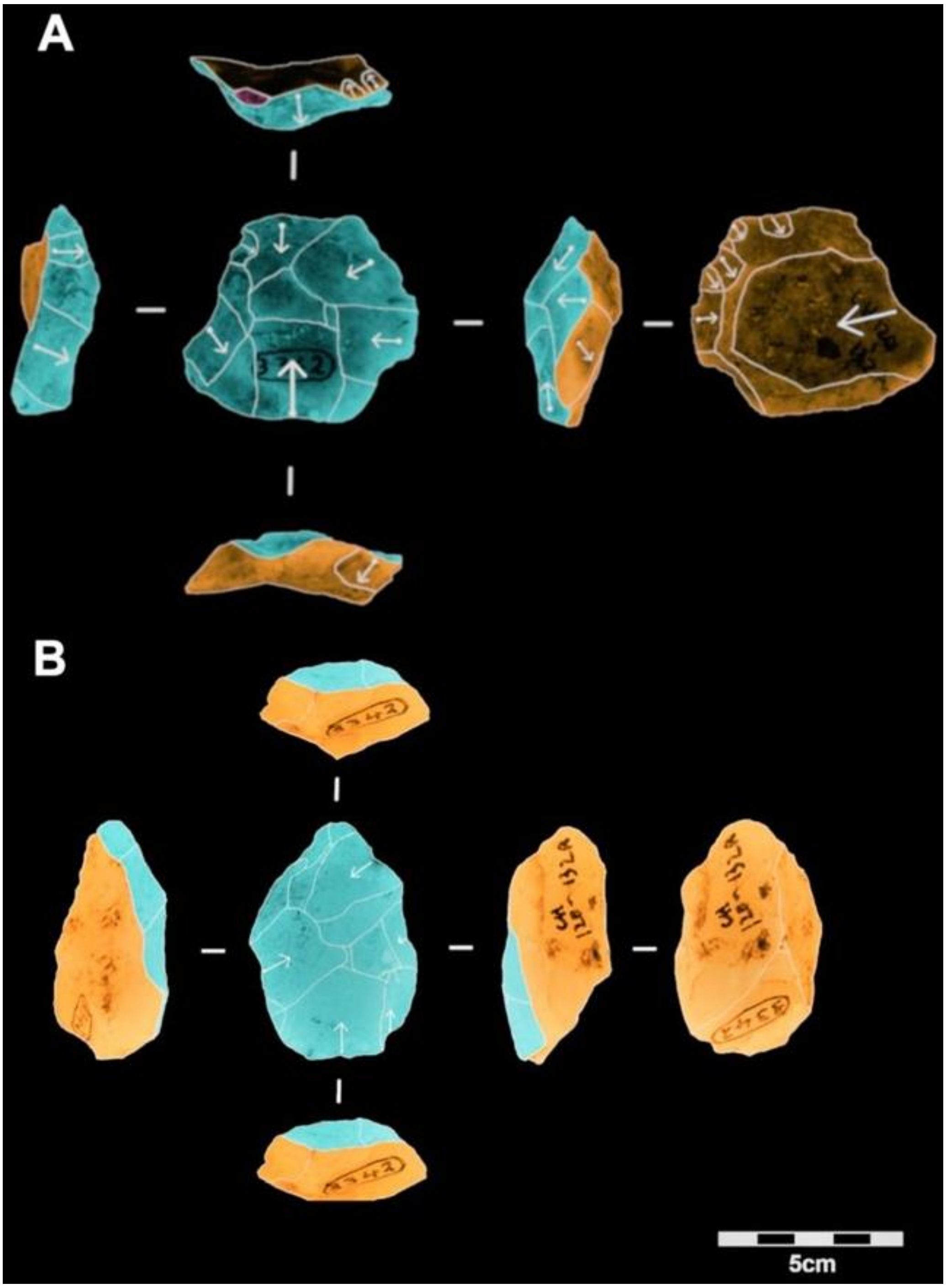

Figure 4.2: A) Levallois preferential flake core in hornfels, B) Informal core in chert, where different colours represent different surfaces and the dotted pattern indicates the presence of cortex.

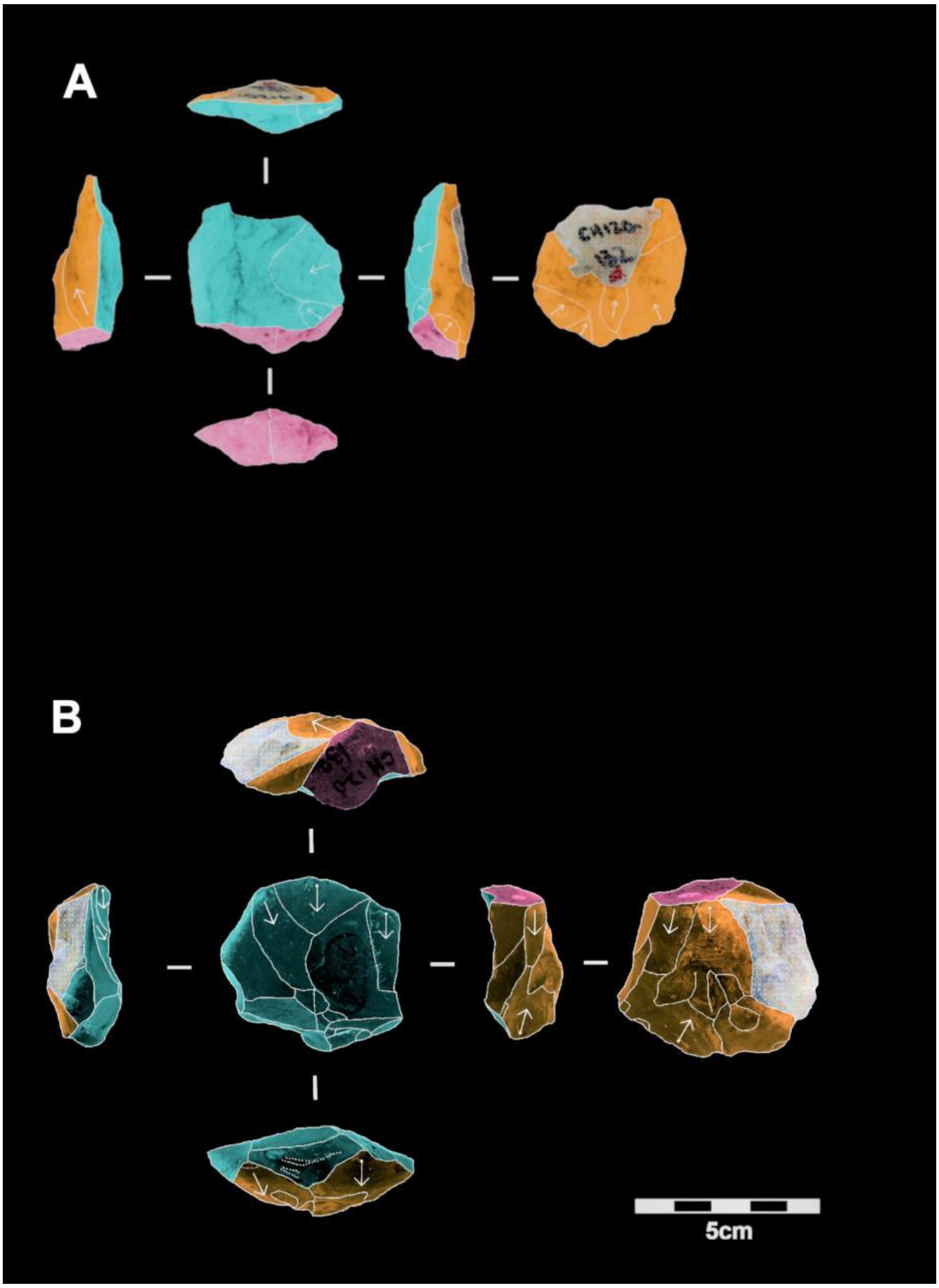

FIGURE 4.3: A) INDETERMINATE CORE IN MILKY QUARTZ, B) HYBRID CORE WITH BOTH PLATFORM AND LEVALLOIS CHARACTERISTICS IN FGD.

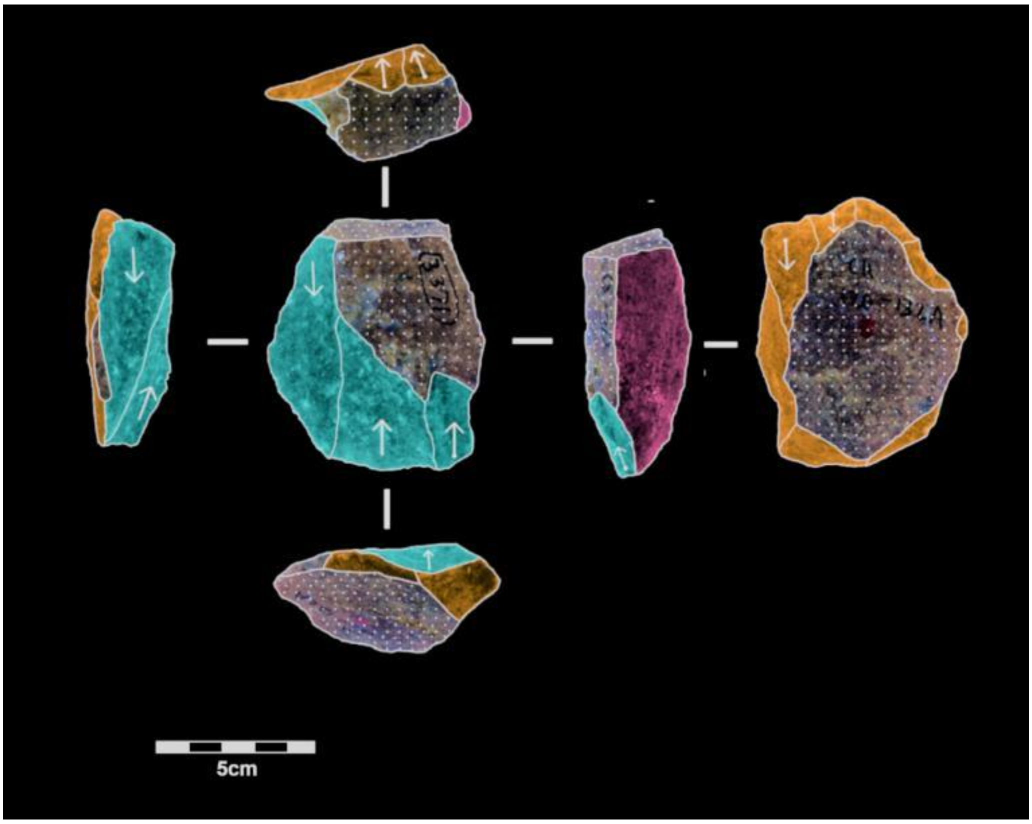

FIGURE 4.4: PLATFORM CORE IN QUARTZITE.

4.1.4 Tools & retouch

The formal tools in Bed 5 included 20 unifacial points and no bifacial points were identified. Most of the points had retouch restricted to the edges, and only one (Fig. 4.5 C) had extensive invasive retouch. The lateral retouch on the points was short to medium, restricted to the edges and on most points continued along at least one edge of the implement. Other formal tools found were denticulates (n=9), scrapers (n=5), laterally retouched tools and notched pieces (n=7) (Table 4.7). A significant number of pieces also showed lateral retouch (n=15) and edge damage (n=37). The lateral retouch on blanks other than points did not continue for more than a centimetre and was short to marginal. The majority of the retouch and edge damage was found on points (n=41; 48%). The formal tools (n=49) made up 6,3% of the overall assemblage. Most of the retouch and edge damage from this assemblage were found at locations on the distal edge (Appendix A1, Fig. A1).

Table 4.7: Bed 5 retouch and tool types.

	Denticulate		Notched		Scraper		Edge damage		Lateral Retouch		Unifacial Points		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total	9	**10,5**	7	**8,1**	5	**5,8**	37	**43,0**	8	**9,3**	20	**23,3**	86	**100**

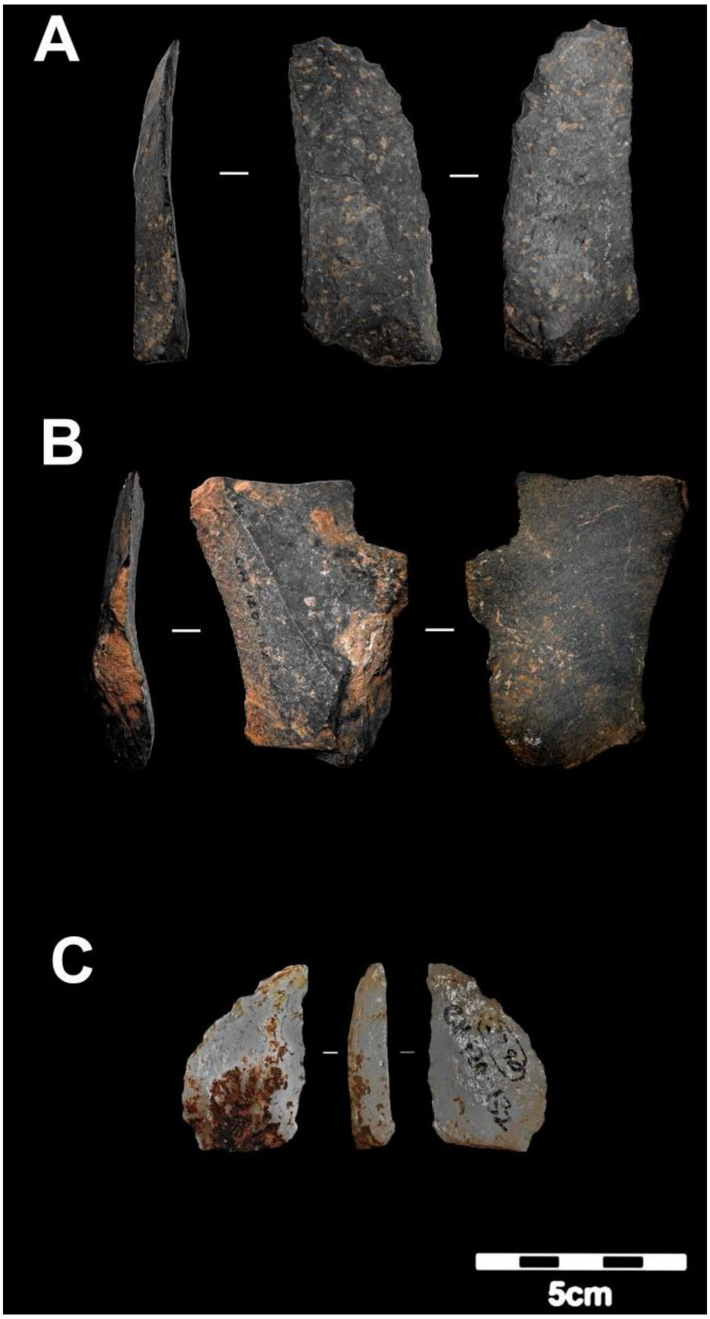

Figure 4.5: A) Denticulate in FGD, B) Notched tool in hornfels, C) Unifacial point type 1 in milky quartz.

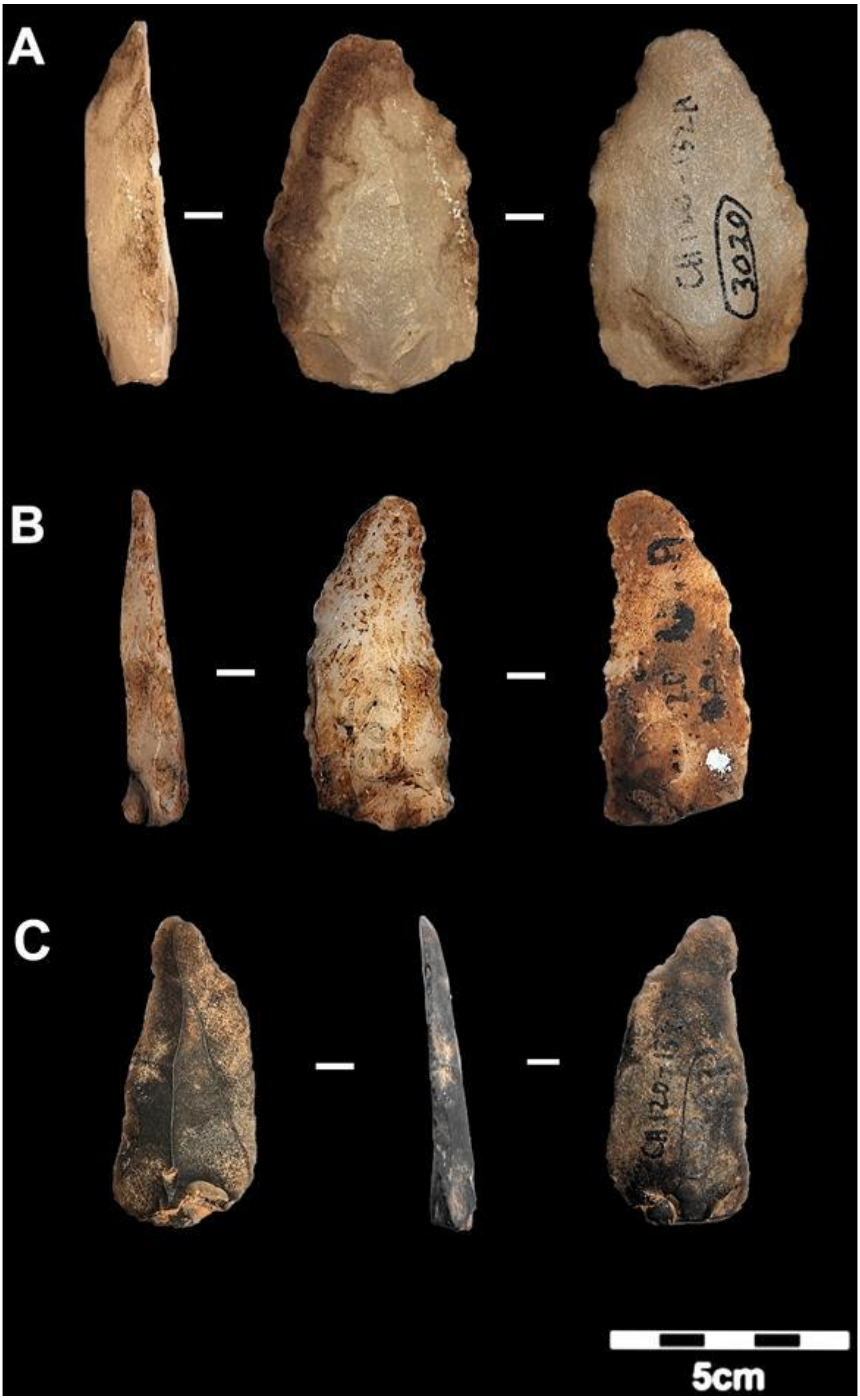

FIGURE 4.6: A) UNIFACIAL POINT TYPE 1 IN CHERT, B) UNIFACIAL POINT TYPE 2 IN MILKY QUARTZ, C) UNIFACIAL POINT TYPE 2 IN CHERT.

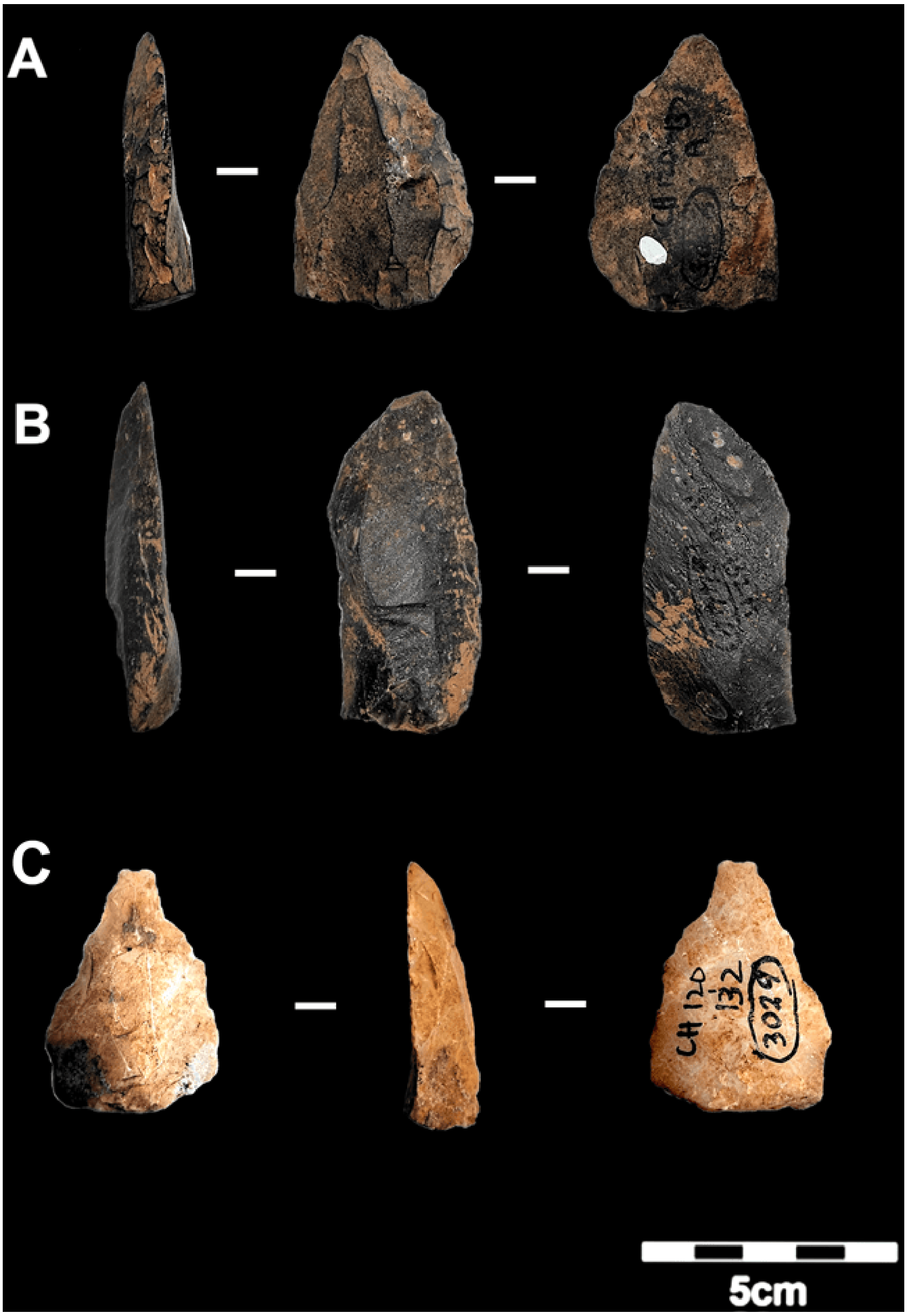

Figure 4.7: A) Unifacial point type 1 in hornfels, B) Unifacial point type 3 in fgd, C) Unifacial point type 1 in chert.

4.2 Results of BOSThree KRM

4.2.1 Assemblage composition

The total number of pieces in the KRM sample from layer BosThree, square C2, C3 B1, B2, B3 was 20929. Squares Table 4.8 shows that the sample consisted of 91,4% flake fragments < 2cm.

Table 4.8: Assemblage composition and raw material of analysed lithics (*% in relation to analysed lithics; **% in relation to grand total) of BOSThree.

	Milky Quartz		Quartzite Medium		Quartzite Coarse		Hornfels		Roofspall		Total			
	N	%	N	%	N	%	N	%	N	%	N	%*	% **	g
Cores	-	-	31	83,8	5	13,5	1	2,7	-	-	37	6,9	0,2	5663
Fragments >2cm	-	-	92	72,4	27	21,3	-	-	8	6,3	127	23,8	0,6	1507
Blades	-	-	71	94,7	2	2,7	-	-	2	2,7	75	14,0	0,4	1022
Bladelets	-	-	51	100	-	-	-	-	-	-	51	9,6	0,2	14
Flakes	-	-	177	87,6	13	6,4	-	-	12	5,9	202	37,8	1,0	5345
Points	-	-	41	100	-	-	-	-	-	-	41	7,7	0,2	1160
Hammerstones	-	-	1	100	-	-	-	-	-	-	1	0,2	0,0	436
Total analysed lithics	**-**	**-**	**464**	**86,9**	**47**	**8,8**	**1**	**0,2**	**22**	**4,1**	**534**	**100**	**2,6**	**15147**
Pebbles	-	-	-	-	-	-	-	-	-	-	730	-	3,5	5324
Flake Frags < 2cm	33	0,2	17967	93,9	1131	5,9	-	-	-	-	19131	-	91,4	1969
Grand Totals	**33**	**0,2**	**18431**	**88,1**	**1178**	**5,6**	**1**	**0,0**	**22**	**0,1**	**20929**	**-**	**100**	**22440**

A total of 534 lithics, were technologically analysed and these included all the plotted and unplotted lithics larger than ≥2cm and bladelets (Table 4.9). The flakes (37,8%) were the majority, the blades contributed 14%, the points 7,7% and the cores 6,9% to the assemblage composition (Table 4.8).

4.2.2 Raw material

Medium-grained quartzite was the most common raw material in this assemblage (88,1%) (Table 4.8). Medium-grained quartzite was probably locally available in the form of beach cobbles accounting for the fact that it is the overwhelming majority (Brenner & Wurz 2019). Milky quartz (0,2%) was also present in this assemblage. However, this raw material was only found in pieces smaller than 2 cm

(Table 4.8). Medium-grained quartzite also dominated the analysed lithics (86,9%). Other contributors include coarse grained quartzite (8,8%) and roofspall (4,1%) (Table 4.8). Hornfels was extremely rare with only 1 (0,2%) piece made of this raw material (Table 4.8).

4.2.3 Technique & method

The platform characteristics of the blades, flakes and bladelets were similar. In the case of all three, most platforms were plain and showed no preparation with weak bulbs and no lipping (Table 4.9). The combination of these attributes suggests that hard hammer percussion might have been used. However, hard hammer percussion usually results in prominent bulbs. Experimental studies on different raw materials might shed some light on why most of the bulbs were weak while other attributes point to hard hammer percussion. An experimental program is currently underway with Christians Lepers and Traceolab (TraceoLab – Study of macro- and microscopic wear traces and residues on prehistoric stone artefacts (ulg.ac.be)) on material from KRM. Contrary to the other blank types the majority of points had faceted platforms and visible bulbs. This suggests that a different technique might have been used for the removal of points. Points with faceted platforms have been regarded as "typical" MSA implements (Goodwin & van Riet Lowe 1929; Wurz 2014; Wadley 2015; Schmid *et al.* 2016)

Table 4.9: Platform and bulb characteristics according to blanks of BOSThree.

Platform Characteristics

Flakes (N=202)			**Points (N=41)**			**Blades (N=75)**			**Bladelets (N=51)**		
Platform Preparation			**Platform Preparation**			**Platform Preparation**			**Platform Preparation**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Indeterminate	4	2,0	Indeterminate	9	22,0	Indeterminate	24	32,0	Indeterminate	43	84,3
No preparation	141	69,8	No preparation	16	39,0	No preparation	38	50,7	No preparation	6	11,8
Trimming	56	27,7	Trimming	16	39,0	Trimming	13	17,3	Trimming	2	3,9
Abraded	1	0,5	Abraded	0	0,0	Abraded	0	0,0	Abraded	0	0,0
Platform Type			**Platform Type**			**Platform Type**			**Platform Type**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Plain	118	58,4	Plain	14	34,1	Plain	37	49,3	Plain	6	11,8
Faceted	52	25,7	Faceted	17	41,5	Faceted	9	12,0	Faceted	0	0,0
Cortical	10	5,0	Cortical	0	0,0	Cortical	0	0,0	Cortical	0	0,0
Linear	11	5,4	Linear	0	0,0	Linear	2	2,7	Linear	2	3,9
Broken	2	1,0	Broken	0	0,0	Broken	1	1,3	Broken	0	0,0
Dihedral	6	3,0	Dihedral	2	4,9	Dihedral	2	2,7	Dihedral	0	0,0
Indeterminate	3	1,5	Indeterminate	8	19,5	Indeterminate	24	32,0	Indeterminate	43	84,3
Bulb of Percussion			**Bulb of Percussion**			**Bulb of Percussion**			**Bulb of Percussion**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Weak Bulb	62	30,7	Weak Bulb	7	17,1	Weak Bulb	27	36,0	Weak Bulb	5	9,8
Visible Bulb	61	30,2	Visible Bulb	12	29,3	Visible Bulb	13	17,3	Visible Bulb	3	5,9
No Bulb	44	21,8	No Bulb	5	12,2	No Bulb	4	5,3	No Bulb	0	0,0
Prominent	30	14,9	Prominent	8	19,5	Prominent	7	9,3	Prominent	0	0,0
Indeterminate	5	2,5	Indeterminate	9	22,0	Indeterminate	24	32,0	Indeterminate	43	84,3
Lipping			**Lipping**			**Lipping**			**Lipping**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Yes	31	15,3	Yes	14	34,1	Yes	9	12,0	Yes	0	0,0
No	167	82,7	No	18	43,9	No	42	56,0	No	8	15,7
Indeterminate	4	2,0	Indeterminate	9	22,0	Indeterminate	24	32,0	Indeterminate	43	84,3

The most prominent category of flakes was indeterminate (Table 4.10). A similar number of flakes were classified as unidirectional (n=32, 15,8%) and core management (n=31, 15,3%) flakes (Table 4.10). However, débordant blanks and crested pieces have elsewhere been associated with core maintenance (Tostevin 2003; Douze *et al.* 2015; Douze *et al.* 2018). Thus, if the core management flakes, débordants and crested pieces are combined, core maintenance pieces are the dominant technological type of the flakes (Table 4.10). This might suggest that flakes were primarily used in core maintenance. The blades and points were similarly dominated by unidirectionally scarred pieces (Table 4.10). However, a lower frequency of blades was categorised as core maintenance pieces and no flakes fell into this category (Table 4.10). Both flakes and blades had crested pieces. Crested pieces are usually linked to blade reduction strategies (Chazan 2014) however no blade cores were identified (see section 4.2.3.1). All bladelets were all classified as indeterminate, this is due to the small size and nature of the raw material that makes identifying the technological type difficult.

TABLE 4.10: SUMMARY OF THE TECHNOLOGICAL ANALYSIS OF BOSTHREE.

		N	%
FLAKES (202)	Unidirectional	32	15,8
	Bidirectional	11	5,4
	Indeterminate	105	52,0
	Core Management	31	15,3
	Débordant	9	4,5
	Crossed	12	5,9
	Crested	2	1,0
	Centripetal	-	-
BLADES (75)	Unidirectional	25	33,3
	Bidirectional	9	12,0
	Indeterminate	33	44,0
	Core Management	-	-
	Débordant	6	8,0
	Crossed	1	1,3
	Crested	1	1,3
	Centripetal	-	-
BLADELETS (51)	Unidirectional	-	-
	Bidirectional	-	-
	Indeterminate	51	100
	Core Management	-	-
	Débordant	-	-
	Crossed	-	-
	Crested	-	-
	Centripetal	-	-
POINTS (41)	Unidirectional	29	70,7
	Bidirectional	3	7,3
	Indeterminate	8	19,5
	Core Management	-	-
	Débordant	-	-
	Crossed	1	2,4
	Crested	-	-
	Centripetal	-	-
	Type 1	17	41,5
	Type 2	20	48,8
	Type 3	3	7,3

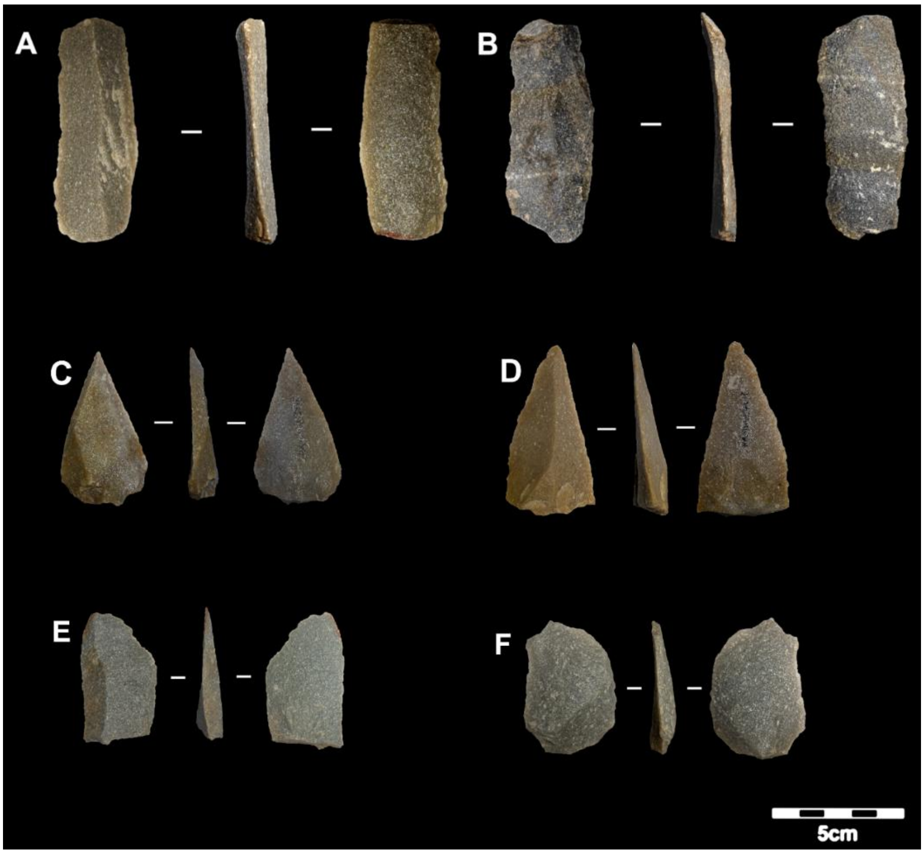

FIGURE 4.8: A) UNIDIRECTIONAL BLADE IN MEDIUM-GRAINED QUARTZITE, B) INDETERMINATE BLADE IN MEDIUM-GRAINED QUARTZITE C) POINT TYPE 1 IN MEDIUM-GRAINED QUARTZITE, D) POINT TYPE 1 IN MEDIUM-GRAINED QUARTZITE, E) UNIDIRECTIONAL FLAKE IN MEDIUM-GRAINED QUARTZITE, F) CROSSED FLAKE IN MEDIUM-GRAINED QUARTZITE.

The flakes had mostly triangular cross-sections, and straight profiles (Table 4.11) whereas the blades contributed 14% (n=75) and bladelets had triangular cross-sections and straight profiles (Table 4.11). Finally, the points similar to the other blank types had mostly triangular cross-sections and straight profiles (Table 4.11). The dominant point type was type 2 (49%), points with blade dimensions. Type 3 was the least common and made up 10% while type 1 made up 41%.

Table 4.11: Geometric attributes according to different blank types of BOSThree.

Flakes (N=202)			**Points (N=41)**			**Blades (N=75)**			**Bladelets (N=51)**		
Cross-section			**Cross-section**			**Cross-section**			**Cross-section**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Triangular	45	22,3	Triangular	33	80,5	Triangular	35	46,7	Triangular	39	76,5
Trapezoidal	39	19,3	Trapezoidal	7	17,1	Trapezoidal	21	28,0	Trapezoidal	3	5,9
Flat	40	19,8	Flat	1	2,4	Flat	2	2,7	Flat	7	13,7
Triangular/ Trapezoidal	0	0,0	Triangular/ Trapezoidal	0	0,0	Triangular/ Trapezoidal	1	1,3	Triangular/ Trapezoidal	0	0,0
Indeterminate	78	38,6	Indeterminate	0	0,0	Indeterminate	16	21,3	Indeterminate	2	3,9
Profile			**Profile**			**Profile**			**Profile**		
	N	**%**		**N**	**%**		**N**	**%**		**N**	**%**
Straight	132	65,3	Straight	32	78,0	Straight	37	49,3	Straight	45	88,2
Curved	44	21,8	Twisted	6	14,6	Twisted	15	20,0	Twisted	0	0,0
Twisted	19	9,4	Curved	0	0,0	Curved	18	24,0	Curved	6	11,8
Indeterminate	7	3,5	Indeterminate	3	7,3	Indeterminate	5	6,7	Indeterminate	0	0,0

In BOSThree the points were the largest implements in terms of length and width (Table 4.12). The thickness of the points and flakes were quite similar while the blades were the thinnest (Table 4.12). The points also had the largest platforms both in thickness and width. The points were not only relatively large compared to other blanks but also compared to the mean core sizes (Table 4.12; 4.13 & Fig. 4.9). The points were significantly different from the flakes and blades in terms of width and platform width (Appendix A; Table A3).

The blades were the thinnest between the flakes, blades, and points. The thickness values of the blades were also significantly different from both the flakes and the points. Further, the platform thickness to length ratio was the largest in the blades (Table 4.12). Bladelets were thinner than the blades, but this is to be expected. The bladelet values of thickness, width, platform width, platform thickness and platform thickness to length ratio were all significantly different from corresponding values from the other blank categories. An interesting find is the remarkable similarity of the maximum length measurement of all three categories (Table 4.12).

Table 4.12: Measurements of all blanks of BOSThree.

	Statistic	***Flakes***	***Blades***	***Points***	***Bladelets***
Length	N	127	26	26	0
	Max	116,2	116,1	116,1	-
	Min	16,5	24,5	45,4	-
	Mean	49,1	62,5	76,5	-
	CV	40,2	46	26,1	-
	SD	19,8	29	20	-
Width	N	202	72	41	51
	Max	94,9	44,7	62	11,9
	Min	4,2	7,9	27,5	3,7
	Mean	34,9	21,7	31,4	6,5
	CV	40,3	41,8	38,3	31,2
	SD	14,1	9,1	12	2
Thickness	N	202	74	41	51
	Max	56,7	29,4	35,7	5,5
	Min	2,3	2,7	9,2	0,9
	Mean	13,3	9,5	13,1	2,5
	CV	58,5	58,9	52	39,5
	SD	7,8	5,6	6,8	1
Platform Width	N	191	53	33	8
	Max	64,6	41,4	60,7	8,1
	Min	5,8	4,3	25,3	3,5
	Mean	24,2	16,5	27	6,1
	CV	47,4	51,7	44,9	28,9
	SD	11,5	8,5	12,1	1,8

Table 4.12 Continued.

	Statistic	*Flakes*	*Blades*	*Points*	*Bladelets*
Platform Thickness	N	193	51	33	8
	Max	27,7	19,4	60,5	4,1
	Min	2,1	2,3	6,0	1,2
	Mean	9,8	8,4	13,1	2,1
	CV	49,8	56,6	61,1	43,5
	SD	4,9	4,9	8,1	0,9
Platform thickness: Length ratio	N	120	25	26	0
	Max	17,1	14,3	17,5	-
	Min	1,7	3,9	2	-
	Mean	4,6	7,4	5,6	-
	CV	58,3	35,5	56,8	-
	SD	2,7	2,6	3,2	-

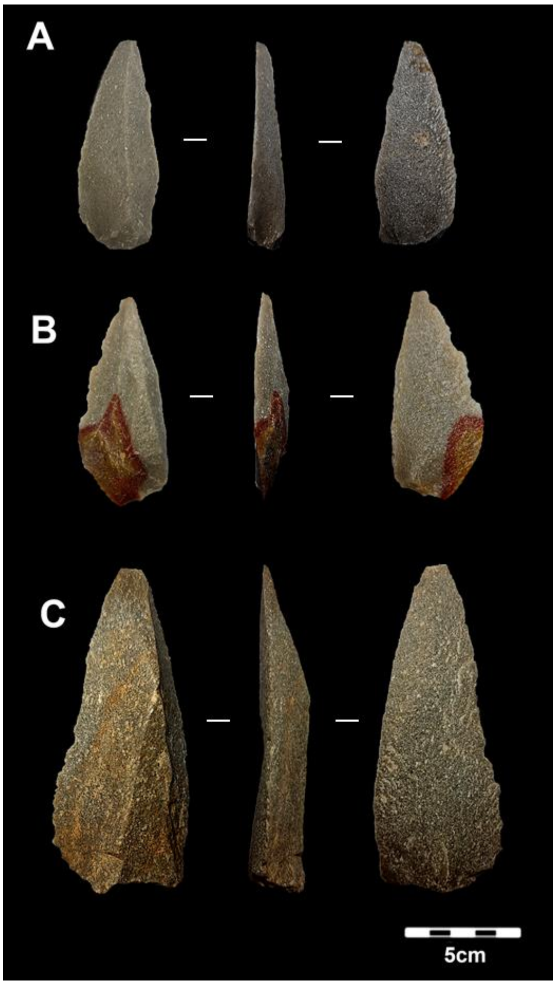

Figure 4.9: A) Point type 2 in medium-grained quartzite, B) Point type 2 in medium-grained quartzite, C) Point type 2 in medium-grained quartzite

4.2.3.1 Cores

25,7% (n=95) of the blanks had cortex and 48,9 % (n=23) of the cores retained some cortex. Most cortex came from cobbles which are to be expected as quartzite cobbles are present in abundance in the vicinity of the site. The majority of the cores were also made from medium quartzite (83,8%) this is in accordance with most blanks being made of the same material (Table 4.9; 4.13). There was also 1 (2,7%) core made of hornfels and 5 (13,5%) of coarse quartzite. The tested cores were all in very coarse quartzite, which may suggest that a finer quartzite grain was desired (Fig. 4.10 A).

The blank type for most cores were probably quartzite beach cobbles. The cortex found on cores are smooth with "chatter marks", similar to the cobbles found adjacent to the site. The core made of hornfels also had a cortical exterior but was the size of a pebble. Many of the cores were put into the category of indeterminate (n=8, 21,6%). Other prominent core types include informal (n=13, 35,1%) and platform (n=8, 21,6%) type cores (Table 4.13). Most of the platform cores only had one platform. There were however two double platform cores, these were significantly bigger than the single platform cores (Fig. 4.10 B; 4.11 A). The average scar size on the cores was 38,1mm, with an average length of 60,9mm, width of 50,5mm and thickness of 29,5mm (Table 4.13). Most cores exhibited flake sized scars although a few also had point sized scars. There were also 3 cores that were classified as second-generation cores. This, as well as the small size of the cores (Table 4.13) in relation to the blanks (Table 4.13), indicate long intense reduction sequences. Other core types present were Levallois (n=4, 10,8%), tested cores (n=3, 8,1%) and core scrapers (n=1, 2,7%) (Table 4.13). The recurrent uni-bidirectional Levallois cores all had an active surface and a cortical surface. In most cases, a few small flakes were removed on the lateral edges of the cortical surfaces for preparation, after which mostly flakes were struck recurrently from one or two opposing directions on the active surface of the core (Fig. 4.11 B). Point scars were rare although some were noted on recurrent unidirectional Levallois cores and platform cores. The pointed scars on these cores were small compared to the mean dimensions of the blanks.

TABLE 4.13: CORE TYPES AND MEASUREMENTS OF BOSTHREE.

CORE TYPE	N	%	AVERAGE SCAR SIZE (MM)	AVERAGE LENGTH (MM)	AVERAGE WIDTH (MM)	AVERAGE THICKNESS (MM)	AVERAGE WEIGHT (G)
PLATFORM	8	21,6	32,3	58,1	48,6	26,9	120,1
LEVALLOIS	4	10,8	32,1	55,2	50,4	23,2	130,1
INFORMAL	13	35,1	41,8	64,9	46,7	31,7	144,8
INDETERMINATE	8	21,6	39,1	58,4	50,8	30,1	106
TESTED	3	8,1	-	40,7	43,7	21,3	290,7
CORE SCRAPER	1	2,7	35,7	102,5	87,6	27,3	207
MEAN	-	-	37,3	60,9	50,5	29,5	153,1
SD	-	-	15,1	19,3	15,5	11,5	122,2
TOTAL	37	100	38,1	60,9	50,5	29,5	153,1

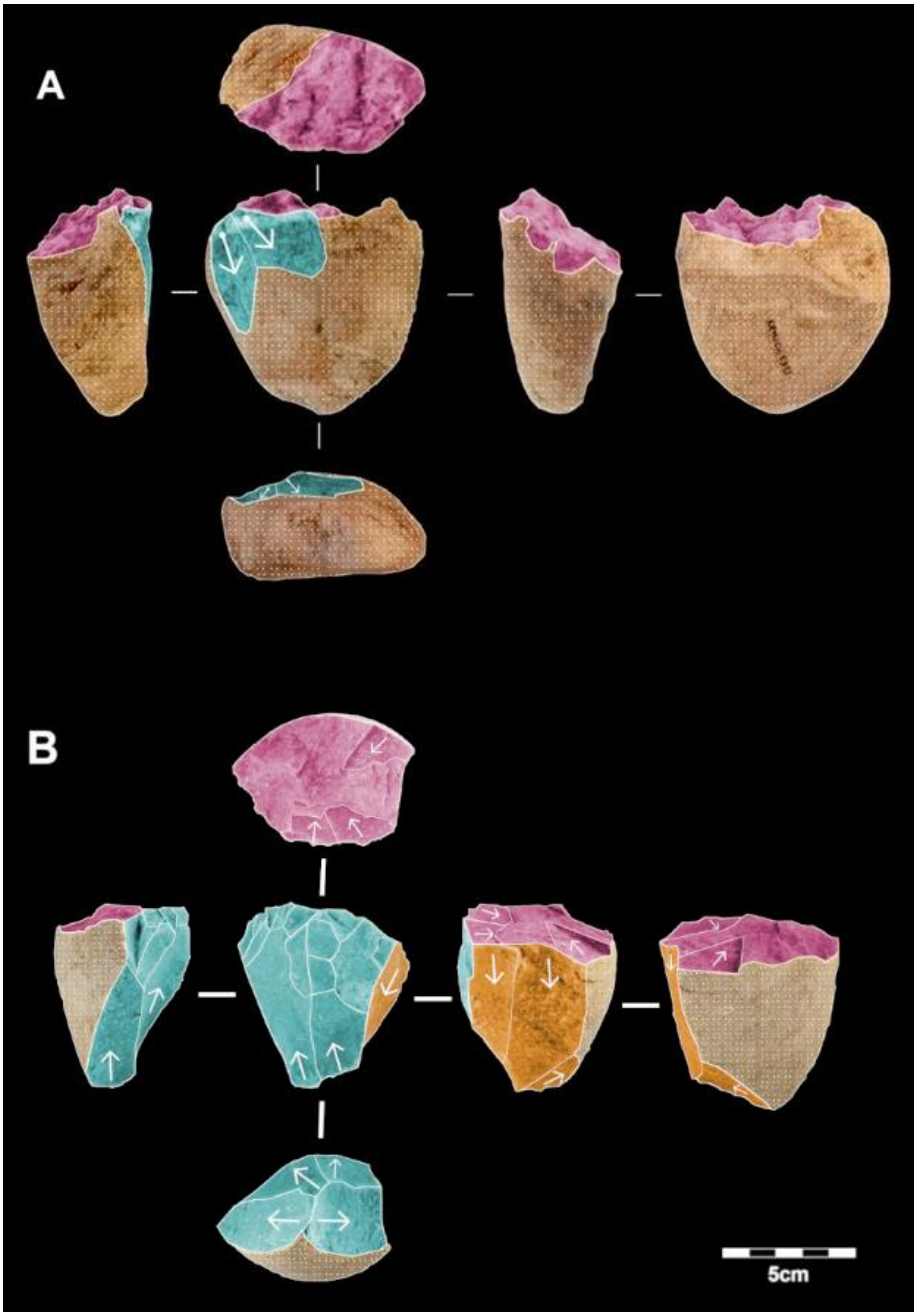

FIGURE 4.10: A) TESTED CORE IN COARSE GRAINED QUARTZITE, B) DOUBLE PLATFORM CORE IN MEDIUM-GRAINED QUARTZITE.

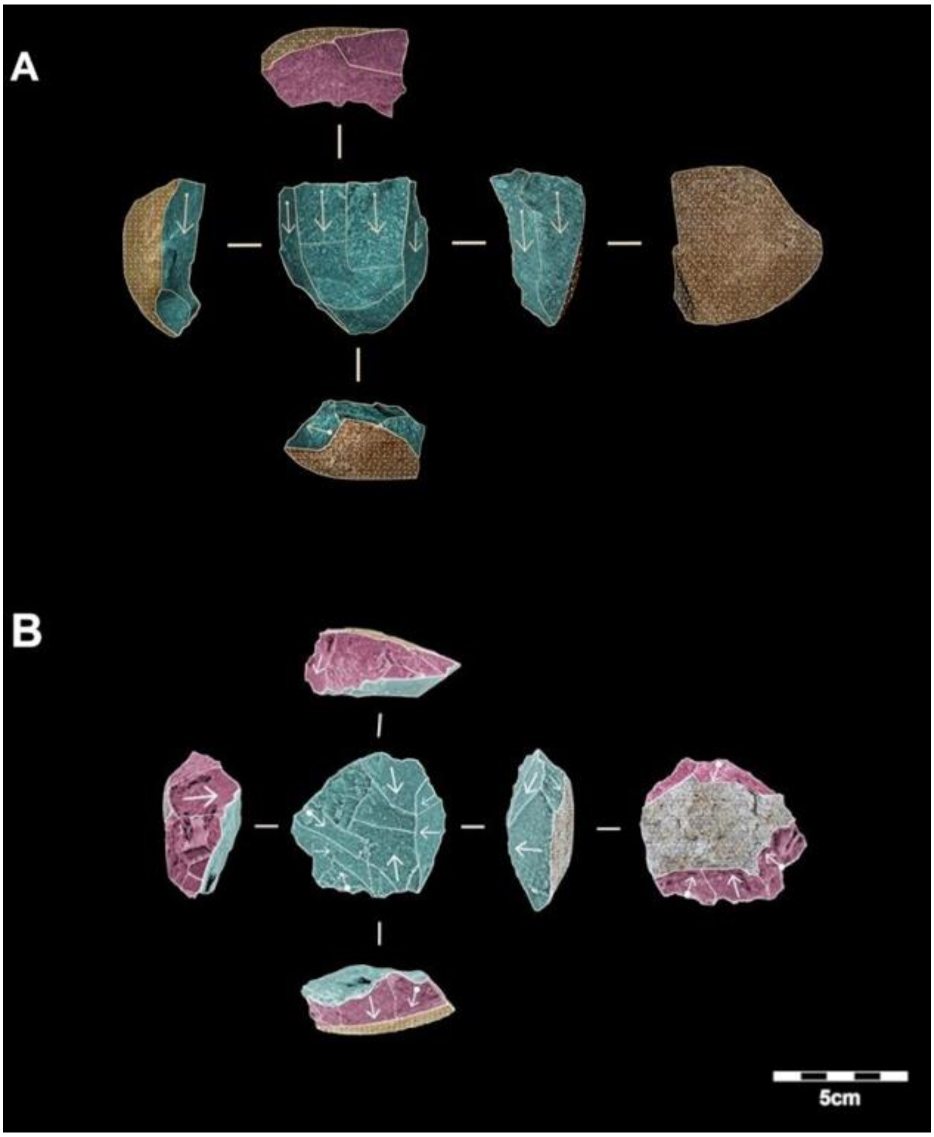

FIGURE 4.11: A) SINGLE PLATFORM CORE IN MEDIUM-GRAINED QUARTZITE, B) RECURRENT UNIDIRECTIONAL LEVALLOIS CORE IN MEDIUM-GRAINED QUARTZITE.

4.2.4 Retouch & tools

Retouch was relatively rare on this assemblage. Only 2,2 % (n=12) of the blanks in this assemblage was retouched while 0,9% (n=5) showed signs of edge damage. The formal tools in this assemblage included denticulates, notched pieces and scrapers (Table 4.14). The most numerous tool type was denticulates (Table 4.14).

On the majority of tools, denticulation and notching appeared on the right side at proximal and distal locations (Appendix A; Fig. A1). No bifacial or lateral retouch was found in this assemblage.

TABLE 4.14: BOSTHREE RETOUCH AND TOOL TYPES

	DENTICULATE		NOTCHED		SCRAPER		EDGE DAMAGE		TOTAL	
	N	%	N	%	N	%	N	%	N	%
TOTAL	7	**43,7**	3	**18,7**	2	**12,5**	4	**25**	16	**100**

FIGURE 4.12: POINT TYPE 3 IN MEDIUM-GRAINED QUARTZITE WITH DENTICULATIONS ON THE PROXIMAL END.

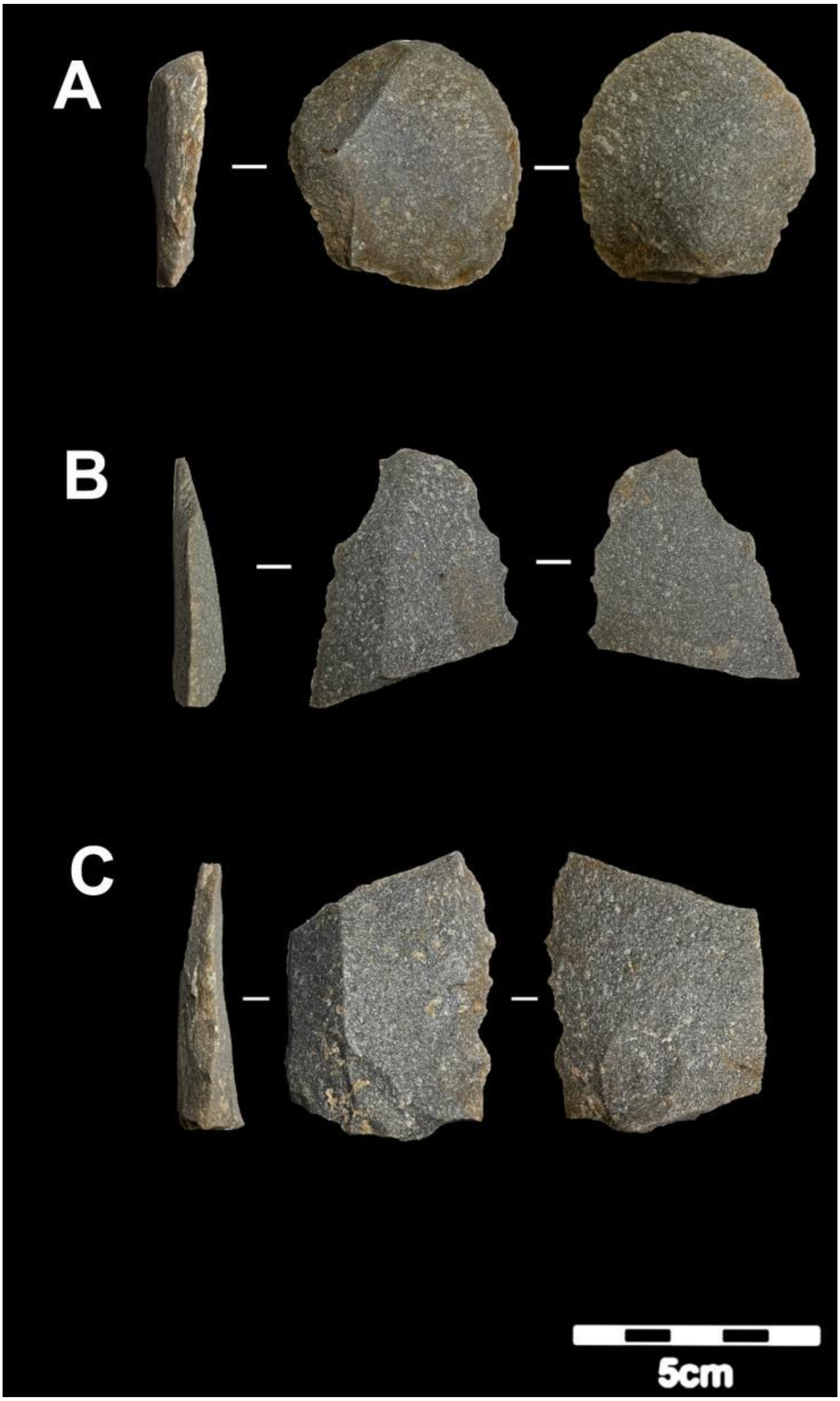

FIGURE 4.13: A) SCRAPER IN MEDIUM-GRAINED QUARTZITE, B) NOTCHED TOOL IN MEDIUM-GRAINED QUARTZITE, C) DENTICULATE IN MEDIUM-GRAINED QUARTZITE

Chapter 5 DISCUSSION & CONCLUSION

The technology of the BOSThree from Klasies River Main site was compared with that from Bed 5 from Cave of Hearths to accomplish the first of the objectives set in Chapter 1. In this chapter the other two objectives will be the focus, namely to technologically compare BOSThree with BED 5 to briefly look at regionalization in relation to this and to evaluate the usefulness of the current notion of techno-complex to do comparison studies. In this chapter, the focus will thus be on highlighting the technological similarities and differences between the two assemblages in relation to raw material exploitation, reduction method, technique and retouch. The appropriateness of the term techno-complex in regard to the studied assemblages will also be discussed. Technological studies can also be used to assess the degree of interconnectedness between groups which in turn shed light on regionalization. Thus, further in this chapter, the results will be used to investigate the degree of interconnectedness according to the four categories as described by Mackay et al. (2014), provisioning systems, implement type, flaking systems and raw material type.

5.1 TECHNOLOGICAL RESULTS COMPARISON

5.1.1 Raw material

Bed 5 had a variety of raw materials and medium-grained quartzite, although being the majority, only made up 41% of the assemblage. Other than quartzite this assemblage also contained, milky quartz, chert, hornfels and indurated shale, listed in order of frequency. The majority of these are locally found (McNabb & Sinclair 2009: 32-38). The cobble and pebble blank types would have been available at the Mwaridzi river directly below COH. The angular blocks were probably taken from outcrops (McNabb & Sinclair 2009). The only exception is hornfels which has not been found in the immediate environment around the cave (McNabb & Sinclair 2009: 32-38). These results are similar to the findings of McNabb & Sinclair (2009). In their study of the Pietersburg Bed 5 similarly was dominated by quartzite while quartz and chert were also common. Mason (1957) also reported quartzite as the majority in Bed 5. Other summer rainfall zone (SRZ) sites that contain MIS 5 assemblages like SC (Schmid *et al.* 2019), RCC (Harper 1997), COH (McNabb & Sinclair 2009), BC (Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), MC (de la Peña *et al.* 2019), BRS (Porraz *et al.* 2018), OBP (Mason 1957) and MEL (Pazan *et al.* 2020) (see Chapter 2 Fig. 2.3) all show dependence on local raw materials.

BOSThree raw material utilisation is overwhelmingly local with 60% quartzite, and few other raw materials were present. Medium-grained quartzite was almost exclusively used in BOSThree with 87% of the analysed lithics being made of this material. Small amounts of coarse-grained quartzite, roofspall and hornfels were also found in this assemblage. All the raw material used in this assemblage can be locally found. Brenner & Wurz (2019), similarly found that quartzite was the most commonly used raw material in the BOS and SMONE layers. MIS 5 assemblages from CSB (Thompson & Marean 2008), DK (Thackeray 2000), PP (Schmid *et al.* 2016; Thompson *et al.* 2010), and BBC (Douze *et al.* 2015) (see Chapter 2 Fig. 2.3) also depended on local raw materials.

5.1.2 Method & technique

Blanks

Bed 5 was dominated by points (35,6). Most blanks, across all three blank categories, flakes, blades and points, had visible bulbs, plain platforms and no platform preparation or lipping. These attributes denote a hard hammer percussion technique. However, hard hammer percussion is usually accompanied by prominent bulbs and neither of the assemblages was dominated by this. This discrepancy might be related to the types of raw material used and needs further investigation through experimental studies. This might also be due to ambiguous terminology. No clear parameters to distinguish between prominent and weak bulbs of percussion could be identified by literature review. Thus, the current classification of bulbs of percussion are subjective to the person doing the analysis, this makes it difficult to compare results from different studies. In his analysis of the Pietersburg at CoH Mason (1957), also found primarily plain platforms in Bed 5/stratigraphic unit 6. Niether his (Mason 1957) nor McNabb & Sinclair's (2009) analysis of Bed 5 from CoH included data on bulbs of percussion.

Most of the flakes, blades and points of Bed 5 had unidirectional or bidirectional scar patterns. Relatively few blanks were classified as core management pieces or débordant pieces which is usually associated with core maintenance activities (Fig. 5.1, 5.2 & 5.3). However, the majority of the cores were very small and exhausted which may indicate core maintenance and rejuvenation (Thompson *et al.* 2010). McNabb & Sinclair (2009) in their analysis found some core maintenance pieces. They suggest that this points to maintenance activities of prepared core technology cores (McNabb & Sinclair 2009).

The Pietersburg recognized at BRS (Porraz *et al.* 2018), MC (de la Peña *et al.* 2019), OBP (Mason 1957), and BC (Backwell *et al.* 2018) all have flake assemblages. At BRS convergent forms are rare (Porraz *et al.* 2018). Triangular flakes, however, are a notable feature at MC (de la Peña *et al.* 2019), BC (Backwell *et al.* 2018) and OBP (Mason 1957). At BC there is also a bladelet reduction sequence associated with the Pietersburg at the site (Backwell *et al.* 2018). Although no bladelets were found in the analysis of Bed 5 here, McNabb & Sinclair (2009) did find a small number of bladelets and bladelet cores in their analysis.

The measurements of the Bed 5 blanks studied here showed that the blades were both the longest and thinnest blank type. Blades also had the largest platform thickness to length ratio (1:7,5). The Mann-Whitney U test done showed that the dimensions of the blades were most significantly different from the flakes and points. Significant differences were not found between the flake and point dimensions. This might suggest that flake sized points were the desired point size. This correlates with the finding that 61,9 % of the points were flake sized. The mean length for flakes (±55 mm) and blades (±70 mm) found by McNabb & Sinclair (2009) were slightly larger than found in this study. However, both this study and the study from McNabb & Sinclair (2009) found the mean length of points to be ± 56 mm.

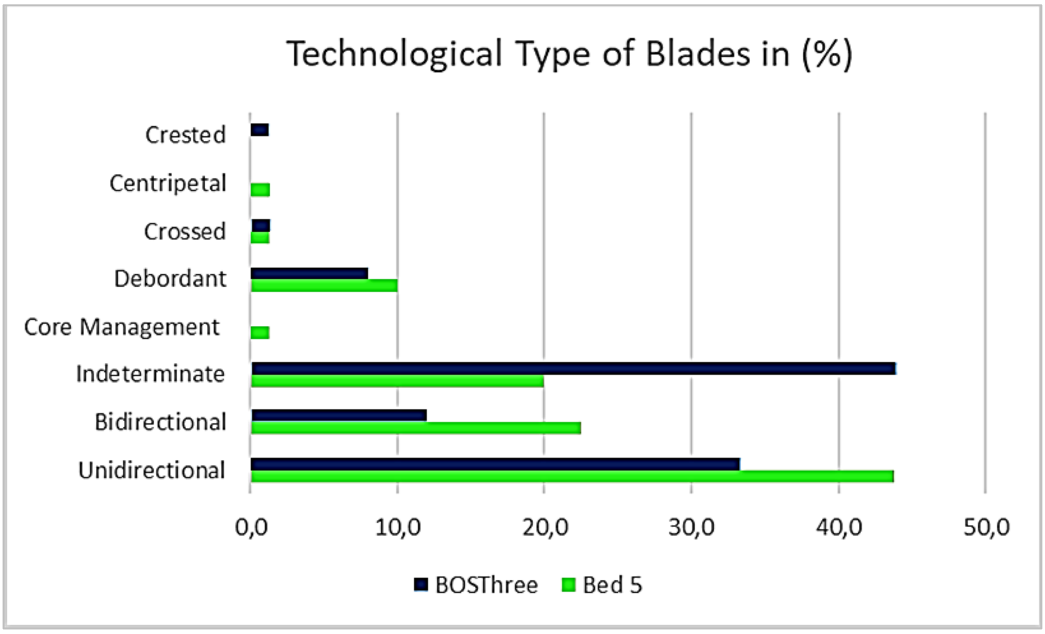

FIGURE 5.1: CHART SHOWING THE DIFFERENT TECHNOLOGICAL TYPE FREQUENCIES OF BLADES FROM KRM AND COH.

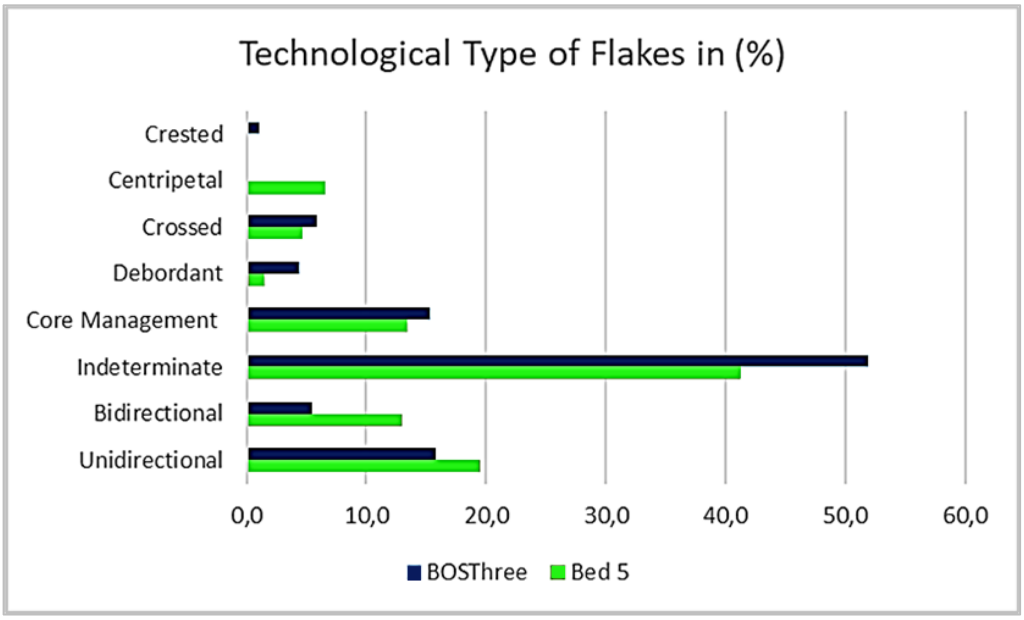

FIGURE 5.2: CHART SHOWING THE DIFFERENT TECHNOLOGICAL TYPE FREQUENCIES OF FLAKES FROM KRM AND COH.

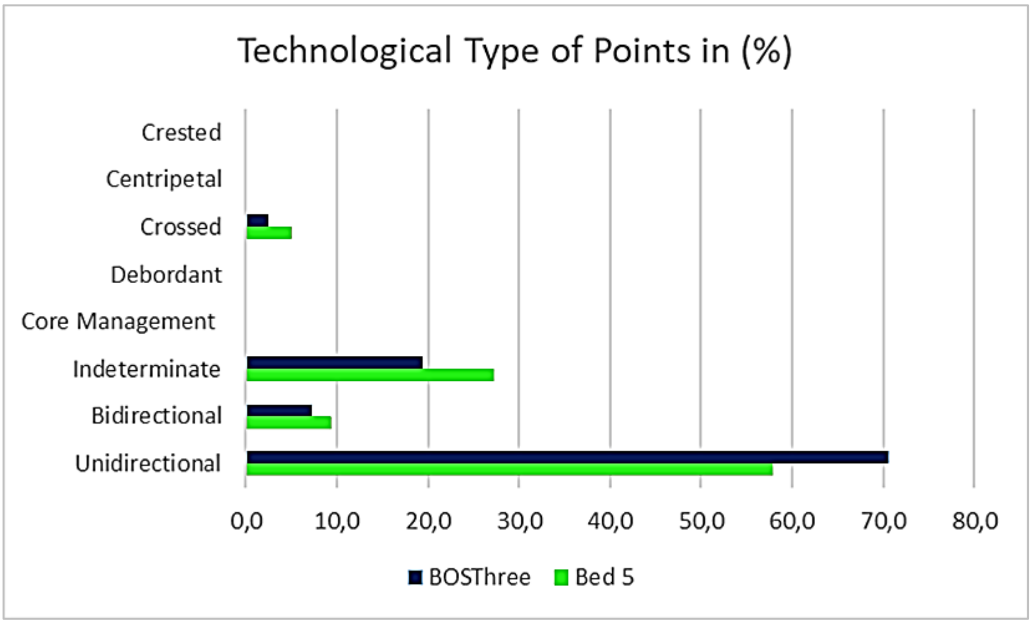

FIGURE 5.3: CHART SHOWING THE DIFFERENT TECHNOLOGICAL TYPE FREQUENCIES OF POINTS FROM KRM AND COH.

BOSThree was dominated by flakes (37,8%) although a higher percentage of flakes were classified as core maintenance pieces compared to unidirectional or bidirectional pieces. However, unlike Bed 5 in BOSThree, there was also some emphasis on blade production. In BOSThree blades, including bladelets, made up more than 23% of the assemblage and the dominant point type was type 2, points with blade dimensions. Thus, it seems that in BOSThree more effort was put into blade production compared to Bed 5. The blades, bladelets and flakes of BOSThree had a lack of platform preparation and lipping with mostly weak bulbs. This is a combination of attributes that point to both hard and soft hammer percussion (Inizan *et al.* 1999; Wurz 2000) and as mentioned above further experimental studies should be done to investigate this. The platform characteristics of the points in this assemblage differed from the rest of the blanks. The points had predominantly visible and prominent bulbs with faceted platforms. Thus, the points from BOSThree were probably removed with a hard hammer percussion technique whereas the percussion technique for the rest of the blanks needs further clarification. Convergent flakes or points with faceted platforms are considered “typical” MSA implements (Goodwin & van Riet Lowe 1929; Wurz 2014; Wadley

2015; Schmid *et al.* 2016). Points specifically with faceted platforms were not a notable feature in Bed 5. Prominent bulbs, associated with direct hard hammer percussion, were dominant in the MSA II studied by Brenner & Wurz (2019). Their analysis of BOSThree found that faceted platforms were prominent in points and blades while plain platforms dominated in flakes (Wurz 2002; Brenner & Wurz 2019).

Unidirectional scar patterns were dominant across all blank categories in BOSThree. However, core maintenance pieces (crested pieces + débordants + core management flakes) exceeded unidirectional and bidirectional flakes. These pieces were probably used for adjusting and maintaining the lateral convexities of the cores (Brenner & Wurz 2019). Core maintenance pieces were less prevalent in the Bed 5 assemblage (Fig. 5.1, 5.2 & 5.3). The presence of crested pieces has been associated with blade cores, although no blade cores were identified in BOSThree studied here. Unidirectional and bidirectional pieces were most prominent in the analysis by Brenner & Wurz of BOS layers from KRM (2019).

The mean length, width and thickness of the flakes, blade, and points were relatively similar between BOSThree and Bed 5. The biggest difference was between the mean point lengths. The mean point length for BOSThree (76 mm) was larger than that of Bed 5 (56 mm). The points were also the largest blank type from BOSThree while blades were the largest in Bed 5. The blades had the largest platform thickness to length ratio in both the Bed 5 (7,5) and BOSThree (7,4) assemblages. This ratio in blades was found to be considerably larger in the MSA II (8,4 & 8,2) studied elsewhere (Wurz *et al.* 2003). There was a remarkable similarity between the maximum lengths of the blades (116,1mm), flakes (116,2mm) and points (116,1mm) of BOSThree. The reason for this might be that the knapper aimed to produce elongated products and this length was the maximum the utilized knapping system would allow. All measurements for the flakes and blades from Brenner & Wurz (2019) for layers BOSOne and BOSTwo above BosThree, were larger than those found in this study. However, the mean point length (76 mm) of this study was larger than the point length (67 mm) found by Brenner & Wurz (2019).

Cores

Bed 5 cores were very small (on average 46 mm in maximum dimension) and all cores were smaller than the average blank lengths. There are several reduction strategies present in Bed 5. The most common method in Bed 5 was an informal reduction method. This may be because of the extended reduction sequences that led to any method being used as long as some potentially useful blanks were obtained. The most common formal reduction strategy in Bed 5 was a preferential flake Levallois method. These cores generally had one organised and one unorganised surface with a large preferential flake scar. A significant number of cores from Bed 5 were also exploited using a single platform method. These platform cores also had some convergent flake scars. If this along with the geometric attributes of points is taken into account, it can be inferred that the reduction method was aimed at producing convergent products with one pronounced ridge.

McNabb & Sinclair (2009) in their analysis of Bed 5 also found platform cores and a large number of “other cores” or cores that does not fall into formal categories. Their analysis does not comment on the specific dimensions of cores analysed, only that refitting was not possible and that cores were discarded at 30mm (McNabb & Sinclair 2009). They also suggest that the largest blanks were possibly made at the raw material source instead of in the cave (McNabb & Sinclair 2009). Pietersburg related assemblages from MC (de la Peña *et al.* 2019), BC (Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), and BRS (Porraz *et al.* 2018; Douze *et al.* 2020) also showed signs of a Levallois strategy. BC, MC and BRS have triangular blanks/ points and unifacial points like the Bed 5 assemblage studied here (de la Peña *et al.* 2019).

BOSThree cores were mostly made from medium-grained quartzite beach cobbles that would have been readily available at the site. There were also three tested cores in this assemblage that was made of coarse quartzite. All three of these cores only had one or two removals after which they were abandoned. It is possible that they were abandoned because they were coarse-grained and the knappers were looking for a more fine-grained material. Like Bed 5 the most prominent reduction strategy in Bed 5 was an informal reduction method. For BOSThree a single platform method was the most frequently used formal reduction sequence. Levallois cores were uncommon in this assemblage and the few analysed were classified as uni-bidirectional recurrent Levallois cores. BOSThree also had a couple of second-generation cores supporting the theory of a long intense reduction sequence, multiple visits to the site or the re-utilisation of recycling of cores. Although the average core size (60.9 mm in maximum dimension) in BOSThree was larger than in Bed 5 the cores were still relatively small compared to the blank sizes indicating a long reduction sequence. A higher number of BOSThree cores had blade scars than Bed 5 cores which supports the idea that some effort went into producing blades as well as flakes. There also seems to be a disconnection between the cores and points. The points were balanced and seem to have been made with some effort while most cores are informally exploited opportunistically. The points analysed are not representative of any of the core scars and in most cases bigger than the average core.

The MSA II layers analysed by Brenner & Wurz (2019) also had platform cores as well as unidirectional Levallois cores. The authors also note some recycled cores supporting the theory of a long reduction sequence. Although their assemblage was also dominated by flakes, they found a higher frequency of points than blades (Brenner & Wurz 2019). Another difference is that unlike the assemblage studied here their findings show that the most common point type was type 1 (Brenner & Wurz 2019). Point production and the use of a variety of reduction methods were found in B13 at PP and M3 at BBC (Douze *et al.* 2015).

5.1.3 Retouch & utilization

Bed 5 formal tools included, lateral retouched, notched pieces, denticulates, scrapers and unifacial points the latter being the most common. 6,3 % of the blanks in this assemblage was affected by retouch. The unifacial points had mostly short-medium retouch covering at least one side of the point. There was also two points with medium to invasive retouch. McNabb & Sinclair (2009) also found notched pieces, denticulates, informal retouch, scrapers, unifacial points and backed pieces in their study. They also found no bifacial points in stratigraphic unit 6/ Bed 5

(McNabb & Sinclair 2009). OPB (Mason 1957), MC (de la Peña *et al.* 2019) and BRS (Porraz *et al.* 2018) had scrapers while BC (Butzer *et al.* 1978; Backwell *et al.* 2018), WC (Beaumont & Vogel 2006), MC (de la Peña *et al.* 2019) and BRS (Porraz *et al.* 2018) had unifacial points. This is similar to the findings in this study. However, it has previously been stated that Pietersburg points are mainly made on blades (Tobias 1949; Mason 1962; Sampson 1974). This was not the case in this analysis where point type 1, with flake dimensions, was more common. According to (Pazan *et al.* 2020) retouch on points suggest hunting with projectiles but further functional analysis studies are needed to verify this.

BOSThree had a lower frequency of retouch (2,2 % for pieces >20mm) compared to Bed 5. Similar formal tools to Bed 5 were found in BOSThree although no unifacial points or lateral retouch was found. Denticulates were the most common tool type in this assemblage. Results obtained by Brenner & Wurz (2019) similarly found denticulates to be the most common formal tool.). Like the KRM assemblage studied here CSB (Thompson & Marean 2008), DK (Thackeray 2000), and BBC (Douze *et al.* 2015) all had formal tool types in the form of denticulates and notched pieces.

5.2 INTERCONNECTEDNESS DURING MIS 5

Based on the results and comparisons done here the following section will investigate the interconnectedness between the groups associated with these assemblages. The discussion of interconnectedness will be done using the four criteria from Mackay et al. (2014) as explained in Chapter 2.

5.2.1 Raw material

Although raw material types differ between Bed 5 and BOSThree both assemblages were dominated by local raw materials. This concurs with Mackay et al. (2014) observation that generally SRZ assemblages have more fine-grained materials because these materials are locally available. The lack of ‘exotic’ materials might also indicate that long-distance travel did not happen to make the likelihood of information transfer between KRM and CoH slight. The geological dissimilarity might have impeded the transfer of knowledge as some flaking systems depend on certain types of raw materials (Mackay *et al.* 2014).

5.2.2 Provisioning systems

Provisioning systems of both assemblages seem to be similar. In Bed 5 and BOSThree raw materials were transported to the site where the reduction was done. However, as mentioned above the points from BOSThree do not correlate with the cores found. This might suggest that implements were brought into the cave from somewhere else. In the case of Bed 5, there might be a possibility that initial reduction was also done elsewhere based on the lack of cortex. However, the lack of cortex might also be because raw material was obtained from outcrops and not solely from beach cobbles as in the case of BOSThree. There was also no flaking debris to be analysed in the sample study to verify or disprove this notion. Nevertheless, because of the presence of cores, blanks and retouched pieces present in Bed 5, it can reasonably be assumed that the bulk of the reduction happened at the site. Thus, based on Mackay et al. (2014) criteria both groups responsible for the making of the two assemblages had a place provisioning system. However, since both assemblages used locally sourced raw materials this cannot be strictly considered place provisioning. Further, this implies that predictable resources were available. This begs the question of why the reduction methods of both assemblages were long and intense if resources were predictable. Lithic and shellfish studies at KRM found changes within the MIS 5 c-d (Brenner *et al.* 2020). These studies found a lower density of shellfish in BOSThree as well as a higher frequency of small debitage and fewer formal elements compared to BOSTwo, BOSOne and SMONE (Brenner *et al.* 2020). Brenner et al. (2020) conclude that the site was mainly used as a manufacturing site during BOSThree. The results from the study done here similarly found a large number of small debitage with a low frequency of formal elements including edge damaged pieces (Table 3.1 & 4.8). This supports the theory that KRM was used as a manufacturing site and not an occupational site during BOSThree. If KRM was used as a manufacturing site the high percentage of small debitage and low percentage of tools and blanks might indicate that a lot of manufacturing processes happened at the site whereafter tools were exported to another location. If this was the case blanks such as points might also have been brought into the site from another location explaining why points found in BOSThree are not representative of the associated cores. A taphonomic study done on faunal remains found carnivore activities along with human activities associated with BOSThree (Lap 2020). This further strengthens the hypothesis that KRM was not continually occupied during BOSThree. Similar inferences are currently impossible for CoH as supporting studies on micro-fauna and paleoenvironment at the site during MIS 5 are sparse.

5.2.3 Flaking systems

Flaking systems according to Mackay et al. (2014), refer to how a core is reduced. There are some similarities and some differences in the way in which cores were reduced between Bed 5 and BOSThree. The Bed 5 platform characteristics seem to indicate hard hammer percussion while platform characteristics in BOSThree are ambiguous. In BOSThree, however, points show signs of hard hammer percussion whereas the technique for the other blanks, although unidentified, differs. This difference in technique for different blank types was not observed in Bed 5 assemblage. The results of Bed 5 suggest that reduction sequences were aimed at producing flake sized points. The BOSThree assemblage, however, had predominantly blade sized points as well as a higher frequency of blades and bladelets than Bed 5. The maintenance of lateral convexities seems to have happened at both sites. The reduction methods of the two assemblages have some prominent differences. Although in BOSThree and Bed 5 informal reduction strategies are the most common these cannot really be seen as similar. Informal reduction methods merely state that a core was reduced in the most opportunistic manner, and this may be in the form of various informal methods. It also frequently represents the last stage in the reduction of a core. Thus, this dominance of informal reduction method might speak more to the intense reduction strategies of both assemblages. This, as mentioned earlier is supported by the relatively small cores. The formal reduction method of the assemblages however was different. In BOSThree platform cores were most prevalent compared to Levallois cores dominating in Bed 5. Although BOSThree also had some evidence of a Levallois strategy this was uncommon these were unidirectional recurrent cores and not recurrent centripetal as in the case of Bed 5. The different flaking systems in conjunction with the distance between the two sites probably mean that prolonged interaction did not happen during the MIS 5 between the groups producing BOSThree and Bed 5 lithics.

5.2.4 Implement type

The retouch types and frequencies of the two assemblages were quite different. The two assembles did share some tools types including denticulates, scrapers and notched pieces. However, not only did Bed 5 have a higher frequency of retouch, but this assemblage also had unifacial points and lateral retouch not found in the BOSThree assemblage where denticulates were the most common. What seems to be similar during MIS 5 is the presence of Levallois-like points (as suggested by Douze *et al.* 2020; see also McBrearty & Brooks 2000 for regional expressions of points, Fig. 5). These were however produced according to different methods. Points from KRM had mostly faceted platforms while Bed 5 point had plain platforms and were predominantly flake sized. Following Mackay et al. (2014) criteria this suggests that the two groups probably did not have any type of interaction as only superficial interaction is required for the transfer of information regarding implement types. Mackay et al. (2014) also found that bi-facial and uni-facial retouch on points was more common at SRZ sites like CoH compared to WRZ-YRZ sites like KRM. The findings of this study correspond with this statement as unifacial points were the most common tool type in Bed 5 while no such implements were found at BOSThree.

5.2.5 Limits

Some of the boxes of CoH could not be found and Bed 5 was chosen as this Bed appeared to be the most complete. Even though the sample is incomplete, it still consisted of sufficient cores, blank types and retouch pieces to make relevant inferences. The findings of this study might change if other relevant materials could be located. However, as there are similarities between the sample studied here and other Pietersburg assemblages discussed in section 5.1 it is likely that this study captures significant aspects of the Pietersburg. The one element that seemed to be missing was the small debitage. For the purpose of this study Mackay et al's (2014) criteria was used to evaluate the similarities between the two assemblages in question. With the pieces that were present in this sample it was still possible to technologically deduce the flaking systems used and most prominent implement types present. The lack of small debitage does however, limit the inferences that could be made about where initial and most of the core reduction was done which may influence the investigation of which provision systems was employed. It further hamper the investigations into lithic miniaturization (Pargeter & Shea 2019). Although the sample seems to be incomplete this is probably due curational issues. One of Masons's goals with the Pietersburg sample was to break free of the typological and technological restraints of lithics studies and instead focus on quantitative data sets (Mason 1957: 119-120).

A second aspect that pose as a possible limitation in this study is the lack of dates using contemporary dating methods associated with the Pietersburg at CoH. Because there is no current date that can be associated with the Pietersburg at CoH it is impossible to know if the two assemblages studied here were made more or less with in the same time period. If however the assemblages were created millennia apart this would not influence the results found here – that the assemblages do not belong to the same cultural entity. If the groups responsible for the assemblages did not coexist in the same time it would however impact the results found here concerning the possible contact between the two groups and regionalization in general. More detailed and modern dating is thus needed for the Pietersburg's at CoH to corroborate the findings presented here regarding coalescence of these groups and regionalization.

5.3 THE SAME?

It seems that ambiguous and imprecise definitions of the terms Techno-complex and Industry often lead to the incompatibility of studies. Defining lithic assemblages as *Techno-complex* and *Industry* should ideally allow authors to compare assemblages of the same hierarchical level. As explained in Chapter 2, hierarchical order refers to the position of rank a cultural stratigraphic term occupies in relation to other cultural stratigraphic terms (see Fig. 2.1 & 2.2). However, in many archaeological studies, as also discussed in Chapter 2 (section 2.1) these terms remain undefined or are used interchangeably. Consequently, these terms are currently not operational to compare lithic assemblages. Nevertheless, it is concluded here that the assemblages studied here do not belong to the same cultural entity be it *Techno-complex* or *Industry*. To belong to either the same *Techno-complex* or *Industry* the Pietersburg and MSA II assemblages compared here needed to exhibit comparable technologies in relation to implement type and flaking systems. The results of this study showed that techniques, reduction methods and frequency and type of retouch differ between Bed 5 from CoH and BOSThree from KRM. Based on the criteria of Mackay et al. (2014) there was thus also no interconnectedness between the knappers responsible for making these assemblages. The result obtained here supports the theory that regionalization was present during the MIS 5. Further studies are needed to determine the cause of regionalization during this time.

5.4 CONCLUSION

The technological studies from BOSThree of KRM and Bed 5 of CoH show that these two assemblages do not form part of the same cultural entity. The assemblages of BOSThree and Bed 5 do not have comparable reduction methods. Core types suggest that BOSThree was dominated by a platform reduction method whereas Levallois reduction methods were the most common in Bed 5. The blanks of Bed 5 suggest that the knappers aimed to produce flake sized points with pronounced ridges. Points were also part of the BOSThree assemblage where they were knapped with a different technique compared to the other blanks in the assemblage. Core maintenance pieces contributed a higher frequency than unidirectional or bidirectional flakes in BOSThree. BosThree further had some emphasis on blade production not witnessed in Bed 5. Finally, a notable distinction between the retouch of the two assemblages was noticed. Bed 5 had a higher retouch frequency than BOSThree and contained unifacial points and lateral retouch not found in BOSThree. The points that were found in BOSThree did not fall into the category of unifacial point and were not representative of the cores found in association with them. This along with a large amount of small debitage and the low frequency of tools and edge damaged pieces suggest that KRM was used as a manufacturing site during BOSThree. At the moment it is unclear if CoH was used as a processing site during the accumulation of Bed 5 and further supporting studies are needed to investigate this.

It is however impossible to compare these two assemblages in full. This is because the Bed 5 assemblage from CoH is incomplete, lacks recent dates, and has a complex curational history (McNabb & Sinclair 2009). Contextual studies on the paleoenvironment and fauna associated with the Pietersburg are also scarce. In order to fully compare the Pietersburg with the MSA II or any other cultural entity, more information is needed about the CoH. The Pietersburg however is present at other sites with more contextual information regarding the site. Comparison studies between the Pietersburg at these sites and other contemporaneous assemblages across southern Africa will provide more information to understand the degree of interconnectedness and regionalization during the MIS 5. Detailed information on regionalization can further be used to investigate exchange networks and consequently provide more information on *Homo sapiens* behaviour and social networks during the MIS 5 (McBrearty & Brooks 2000).

Chapter 6 REFERENCE LIST

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APPENDICES

APPENDIX A: TECHNOLOGICAL ATTRIBUTES

TABLE A1: SUMMARY OF TECHNOLOGICAL ATTRIBUTES USED IN THIS STUDY

GENERAL ATTRIBUTES	
RAW MATERIAL	Coarse quartzite, Medium quartzite, Milky quartz, Glassy Quartz, Silcrete, Hornfels, Fine-grained dark material, Chert, Indurated shale, Indeterminate
FRAGMENTATION	Complete, Almost complete with broken point, Distal end, Medial end, Proximal end
BASIC CATEGORY	Flake, Blade, Bladelet, Core, Flake fragment
TECHNOLOGICAL TYPES	Bidirectional, Unidirectional, Crossed, Multidirectional, Centripetal, Débordant, Crested blade, Indeterminate
GEOMETRIC PROFILE	Profile: Straight, Curved, Twisted, Indeterminate Cross section: Triangular, Trapezoid, Flat, Indeterminate
MEASUREMENT	Maximum Length, Width, Thickness, Weight
CORTEX PERCENTAGE	<25%, 25-50%, 50-75%, >75%, 100%
BULB	Weak bulb, Visible Bulb Prominent bulb, Negative bulb, Indeterminate, No bulb
LIPPING	Yes, No
PLATFORM	Cortical, Plain, Broken, Dihedral, Linear, Punctiform, Indeterminate, Removed
PLATFORM PREPARATION	No preparation, Abraded, Trimmed
EDGE PRESERVATION	Fresh, Fresh with tiny accidental removals, Abraded, Heavily Abraded
EDGE DAMAGE	Yes, No, Position
USE WEAR LOCATION	A, B, C, D, E, F (Appendix A, Fig. A1)
RESIDUE	Yes, No
HEAT TREATED	Yes, No
RETOUCH ATTRIBUTES	
RETOUCHED TYPE	Very marginal, Marginal, Short to medium, Medium to covering, Covering the whole face

RETOUCH LOCATION	Ventral, Dorsal, Bifacial
RETOUCH ANGLE	Abrupt 90° - 70°, Simple 70° - 40°, Shallow < 40°
RETOUCH POSITION	A, B, C, D, E, F (Appendix A, Fig. A1)

TABLE A.1: CONTINUED

CORE ATTRIBUTES

CORE TYPE	Levallois preform flake, Levallois preform point, Levallois recurrent centripetal, Levallois recurrent uni-bidirectional, Blade bidirectional, Discoid unifacial, Discoid bifacial, Core fragment, Informal core, Platform core, Double platform core
CORE BLANK TYPE	Angular, Pebble, Flake, Indeterminate, Chunk
CORTEX %	<25%, 25-50%, 50-75%, >75%, 100%

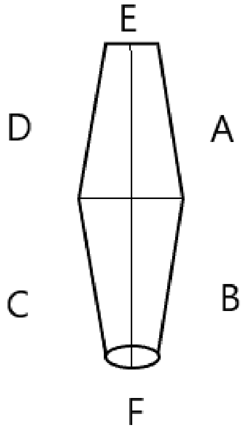

FIGURE A1: LOCATION GUIDE FOR RETOUCH AND EDGE DAMAGE

TABLE A2: P-VALUES OF MANN-WHITNEY U TEST FOR BED 5

	POINTS VS BLADES	***FLAKES VS POINTS***	***BLADES VS FLAKES***
WIDTH	<0.01	<0.01	<0.01
THICKNESS	0.033	0.28	0.065
LENGTH	0.052	<0.01	<0.01
PLATFORM LENGTH	<0.01	0.99	<0.01
PLATFORM THICKNESS	0.058	0.43	0.026
PLATFORM LENGTH TO THICKNESS RATIO	<0.01	0.074	<0.01

TABLE A3: P-VALUES OF MANN-WHITNEY U TEST FOR BOSTHREE

	POINTS VS BLADES	***FLAKES VS POINTS***	***BLADES VS FLAKES***	***FLAKES VS BLADELETS***	***BLADES VS BLADELETS***	***POINTS VS BLADELETS***
WIDTH	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
THICKNESS	<0.01	0.23	<0.01	<0.01	<0.01	<0.01
LENGTH	0.076	<0.01	0.061			
PLATFORM LENGTH	<0.01	0.1	<0.01	<0.01	<0.01	<0.01
PLATFORM THICKNESS	<0.01	<0.01	0.1	<0.01	<0.01	<0.01
PLATFORM LENGTH TO THICKNESS RATIO	0.47	<0.01	<0.01			