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# Analyzing lithic raw material qualities and hominid selectivity in the Early Palaeolithic

Nicole Sherwood

A thesis submitted to the Faculty of Science, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy

Johannesburg, 2019

**DECLARATION**

I declare that this thesis is my own, unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand. It has not been submitted before for any degree or examination at any other University.



Sherwood, N.L.

10th day of December 2019 in Johannesburg

**ABSTRACT**

Numerous studies have been employed to analyse early hominid lithic raw material selection using a variety of different methods, but have not been done for the large majority of sites throughout the world, with the main focus being on East African Oldowan sites. Thus, our knowledge of early hominid behaviour across the world and across time is not nearly as extensive and complete. In addition, a universal methodology to gauge raw material selection has not yet been presented. This is because each archaeological site is unique, making it difficult to do so. Some researchers have made use of rigorous engineering and geochemical testing methods to determine the quality of rock types selected and utilised, while others have applied more qualitative methods or included an experimental aspect to their research. The research presented in this thesis incorporates raw material studies from China and South Africa for both the Oldowan and Acheulean technological time periods. Most importantly it shows the significance of developing a methodology to gauge raw material selection that is unique for each particular site with the aid of experimental knapping. The inclusion of experimental knapping is not only important for determining quality characteristics of rocks for analyses, but it can also help in discovering behavioural aspects of early hominids by isolating specific reasons for their selection choices. Such knapping experiments were performed for the Cradle of Humankind sites Sterkfontein and Swartkrans, as well as for sites in the Danjiangkou Reservoir Region (DRR), central China. In the Cradle, experimental creation and use of tools made from the twelve different available rock types determined which of these rock types were best for tool creation. The experimentally created lithics also provided a basis for comparison with the artefacts from Oldowan and Acheulean assemblages at both sites showing that selection was present, and to what extent. The two time periods were compared to each other and differences between the two sites assessed. The results indicated that there was more selection during the Acheulean and that more selection was practiced at the Sterkfontein site. This is likely due to the larger distance from Sterkfontein to the main source of gravels in the area. Experimental knapping of materials in the DRR revealed that hominid selection for raw material is also present in Asia during the Middle Pleistocene and is just as complex as selection in Africa. Variables for analyses had to be adjusted to suit the uniqueness of the geology of the area as the rock types available in this region are different from the materials in East and South Africa. The rock type most often selected for large cutting tools (LCTs) at the DRR sites (terrace three) is one that frequently exhibits a multitude of visible flaws (quartz phyllite) and is the most common material

available from the local gravels. This might leave one to conclude that raw material selection was absent or highly expedient for the creation of LCTs at this Middle Pleistocene site. Experimental knapping of this material, and the others available, revealed that quartz phyllite was the most optimal for the creation of LCTs. The unique nature of the flaws allowed for cobbles to be easily split in half with little effort. The halves could then easily be shaped into functional LCTs with minimal further shaping, despite the flaws in the material. Furthermore, these flaws could be circumvented or further exploited with knapping skill. Another factor that contributed to this material's usefulness was the ease with which large flakes could be dislodged. Less force was needed to flake this material (much like glassy material) than the quartzites and igneous cobbles, which rarely exhibited flaws. Quartz phyllite is also durable and allowed for exceptionally sharp edges to be created. Experimentation with various knapping techniques indicated that bipolar flaking of quartz phyllite cobbles was the most successful method for blank creation for LCTs. The bipolar knapping of this material made it possible to determine a feature often unique to this technique, namely compression fractures, which could be used to identify which of the Acheulean LCTs were created from bipolar flakes. This technique was present in the assemblages, and shows flexible technological solutions among the Middle Pleistocene hominids living in the DRR. These experiments demonstrated the importance of experimental knapping being included within lithic raw material studies, as it helped show the intricacies of raw material reduction and its associated selection at the sites in this project. This thesis also presents information with regards to the complexities of raw material selection during the Acheulean and the Palaeolithic in Asia.

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# CHAPTER ONE: INTRODUCTION

## 1.1 Introduction

Archaeologists study our ancestors with the aim of understanding our own journey through time and to bring to light challenges our ancestors might have faced in hope that we can learn from our past. In addition, with the aid of the paleoanthropologists, archaeology helps us to illuminate our evolutionary and cognitive development and what factors might have made us the successful species we are today, after all we are the only species on planet earth to have the cognition to want to study and understand our own existence. Research into human evolution have focused on hominid technology (Toth 1984; Dibble 1985; McBrearty and Brooks 2000), mobility (Merrick and Brown 1984; Ambrose 2006; Braun *et al.* 2008a), site variability (Stout *et al*. 2005; Goldman-Neuman and Hovers 2012), adaptability (Hay 1976; Merrick and Brown 1984; Dibble 1985; Brantingham *et al*. 2000; Harmand 2009; Nash *et al*. 2013), landscape utilisation (Blumenschine *et al*. 2008; Braun *et al.* 2008a; Braun *et al.* 2008b; Harmand 2009), knowledge transfer and learning (McBrearty and Brooks 2000; Luncz *et al*. 2018; Proffitt *et al.* 2018). Archaeologists study these aspects to understand why these behaviours exist and to document the variations of hominid behaviour through space and time. These questions are complex and require high resolution and nuanced multidisciplinary datasets that enable us to better understand variability and adaptive strategies in hominid behaviour. To gain an understanding of these complexities through time we need to study technologies left behind by our ancestors. Stone tool technology, an innovation started perhaps by pre-*Homo* hominids, provides us the opportunity to examine many of these themes when very little behavioural evidence is preserved. Stone tools are the most abundant evidence we have of hominid technology, as anything organic worked or used by them normally does not preserve in the archaeological record, or is extremely rare, such as worked bone (Brain 1993; Backwell and d'Errico 2001; Backwell and d'Errico 2003; Backwell and d'Errico 2008; Backwell and d'Errico 2009; Stammers *et al.* 2018). The success of tools made from stone is reliant on the type of rock that it is made from, as some rock types are easier to flake, more durable and sharper than others. Thus, studying rock sourcing and selective behaviours provide archaeologists with insights into hominid cognitive complexity with regards to their understanding of the properties of different rock types, as well as their mobility, landscape use and adaptability.

According to Goldman-Neuman and Hovers (2012:10), rock selection "can be viewed along a behavioural continuum from very simple exploitation, by default of raw material availability, to more complex patterns of behaviour, involving a large number of selection criteria". Therefore, to gauge the degree of hominid rock selection one needs to investigate multiple selection criteria and place these into an environmental and technological context. It is also paramount to investigate site variability and the changes from one techno-complex to another. Studying many different sites will give a bigger picture of hominid raw material selection for a particular time period, as not all sites will express the full complexity of early hominids due to different environmental challenges. This also enables archaeologists to determine what influences the landscape had on hominid choices. Gauging differences between techno-complexes will indicate whether hominid understanding of rock properties and associated behaviours became more complex through time (Sherwood 2013).

Random selection of rocks by early hominids would indicate that they had little capacity for gauging characteristics that assist or hinder the creation and use of stone tools. Lithic raw material selection for the Lomekwian (3.3 Ma) has yet to be studied in detail to indicate whether selection was present, and to what extent (Harmand *et al*. 2015). A number of studies has indicated that the Earlier Stone Age (ESA) hominids in East and South Africa not only selected certain rock types (Toth 1985; Kuman 1996; Isaac *et al.* 1997; Ludwig and Harris 1998; Field 1999; Semaw *et al.* 2003; Stout *et al*. 2005; Harmand 2009; Goldman-Neuman and Hovers 2012; Sherwood 2013; Braun *et al*. 2019), but they were also capable of selecting better quality varieties of those rock types (Stout *et al.* 2005; Braun *et al*. 2009; Goldman-Neuman and Hovers 2012; Sherwood 2013; Braun *et al*. 2019). This indicates that as early as 2.6 - 2.5 Ma hominids already knew that there are a variety of rock types and that some of these types knap more easily and could be better for certain uses. In addition, we have not as of yet conducted extensive raw material studies on Early Palaeolithic sites across the world or covered multiple Oldowan and Acheulean sites from a variety of different geographical locations to confirm that these behaviours were more widespread. Studies comparing behavioural difference from one techno-complex to another are also not done very often due to constraints, such as difference in location and environment. This and many other constraints also make it rather difficult to devise a universal methodology to guide raw material studies due to the varying nature of site locations and associated raw materials. The goal of this thesis is to show how current methods can be applied to sites of different periods and on different continents with the aid of experimental knapping and landscape surveyance.

## 1.2 Research goals

Before discussing the research goals, it is important to clarify the difference between the Early Stone Age (ESA), the Palaeolithic and the Middle Pleistocene periods to avoid later confusion. ESA (3.3 Ma – 300 ka) technology includes technologies synonymous with the Oldowan and Acheulean industries found in Africa, but the equivalent earliest technology in Asia is termed the Early Palaeolithic (from ca. 1.7 Ma). The technologies studied in this thesis from the Cradle of Humankind (South Africa) are Oldowan and Acheulean industries and are thus part of the ESA, whereas the technologies studied in the DRR in China is Acheulean technology, but dated within the Early Palaeolithic era during the Middle Pleistocene epoch (780 – 125 ka). Thus, when referring to ESA technology this thesis includes assemblages that were studied in the DRR in China.

As mentioned in the previous section, research with regards to raw material procurement has not been done in all parts of the world where ESA technology is present. This is especially true for some parts of Asia such as in China. Research into more ESA sites around the globe will help us gather a broader understanding of early hominid behavioural complexity. This thesis incorporates site locations from two continents and introduces more extensive raw material studies for the Early Palaeolithic in China as well as raw material selection in South Africa, which adds to the understanding of early hominid behaviours determined for East Africa.

Moreover, raw material studies are often conducted in a variety of different ways, as no universal method for doing so has been agreed upon. A universal methodology to gauge raw material studies would allow for easier comparisons between different sites around the world, but such a methodology would be difficult to implement as sites around the world are vastly different, not only in habitat, but also raw material availability. One thing that the research in this thesis brings to light is that the incorporation of extensive experimental knapping in a study gauging lithic raw material selection is exceptionally useful in helping understand early hominid raw material selection behaviours and why these behavioural decisions were made. Utilising geochemical and engineering methods to measure properties of rock, such as their hardness, coarseness and fracture toughness, would scale rocks according to these attributes and thus their usefulness for creating tools. However, this takes away human aspects that are used during knapping, such as skill which can improve, adjust and adapt. Knapping various

materials provide an actualistic and holistic understanding of raw material flaking attributes and how they function together. Knapping of all locally available materials not only helps one to gain an actualistic perspective of the behaviours of the different raw materials, but knapped tools can also be used as a basis for comparison to the archaeological assemblages to gauge the degree of selection for quality present at a site. The knapping process also helps to isolate variables that can be measured to assess the quality of those specific rock types.

The studies in this thesis make use of the methodological framework set out by Sherwood (2013), which focusses heavily on experimental knapping and is used for the study locations in this thesis to show its importance in raw material investigations. Sherwood's methodology consists of using extensive knapping of locally available raw materials near a site, thus getting an actualistic experience with the available materials. This also allows for the creation of variables to measure that are unique to the local materials and challenges hominids would have faced using these specific materials. The project investigates selection in the Cradle of Humankind World Heritage Site (COHWHS) in South Africa for two sites, Sterkfontein and Swartkrans, as well as Middle Pleistocene sites in Danjiangkou Reservoir Region (DRR), central China. The Cradle sites were selected as the sites are close together (1 km apart) and both have Oldowan (ca 2 Ma) and Acheulean (ca 1.7-1 Ma) assemblages present. Moreover, tools from all these assemblages were made from the same geological sources, allowing for direct comparisons between the two sites with regards to raw material quality selection. The presence of both Oldowan and Acheulean technologies also allow for comparisons over time. Research by Sherwood (2013) for the Swartkrans site, shows that raw material selection was present during the Oldowan and Acheulean. This thesis now expands the research by including data for the Sterkfontein Oldowan and Acheulean to allow for inter-site comparisons and to broaden our understanding of raw material selection in this region during the ESA. These two sites will not only help to gather extensive data on rock sourcing and selection, but they will also aid in understanding site variability and hominid landscape use, as the Oldowan and Early Acheulean technologies of the two sites differ despite their comparable ages and proximity.

The research questions explored for the Cradle are:

1. Is selection for raw material quality present at Sterkfontein, as has been shown for the Swartkrans Oldowan and the Acheulean?

2. If there are selective differences between the two sites, what reasons could explain their existence?
3. Overall for the two sites, is there an increase in quality selection during the Acheulean, compared to the Oldowan?
4. What does this data add to our current understanding of hominid behaviours?
5. How have extensive knapping experiments aided this study?

The Middle Pleistocene sites in the DRR, were selected to test the application of the methodology set out by Sherwood (2013) to sites with a different geological setting, as well as to gauge lithic raw material selection in central China for this time period. Raw material sourcing and selection have not been studied extensively in East Asia, and Acheulean technologies in this part of the world are often considered less refined and distinct from their European counterparts. For example, Asian handaxes have been shown to be generally thicker and heavier (Kuman *et al*. 2014), and it is argued that the poorer quality materials available in East Asia is likely the reason why this dissimilarity exists (Leng and Shannon 2000; Leng 2001; Bar Yosef *et al*.2012).

Research questions explored in the DRR:

1. Is there selection for raw material quality in the DRR?
2. How have extensive knapping experiments aided this study and what technological behaviours can be inferred from the results?
3. What does this add to our current understanding of hominid behaviours in the DRR during the Middle Pleistocene?

The overall research goals are to test Sherwood's (2013) methodology for inter-site comparisons and diachronic comparisons to assess selection behaviour on two different continents, Africa and China. The research will also address selection and illuminate the complexity of hominid behaviours through time, which will be discussed in the concluding chapter.

### 1.3 Organisation of the thesis

Chapter Two provides the literature review and discusses the relevant studies pertaining to lithic raw material selection and associated hominid behaviour through time. A separate chapter on Materials and Methods is not included in the thesis because these topics are covered separately in the three following chapters (two of which have been published), where the methods have been catered to the specific sites and their raw materials. Chapter Three explores raw material selection in the Cradle of Humankind, South Africa, discussing the materials and appropriate methods for these sites and comparing the Oldowan and the Acheulean assemblages of Sterkfontein with that of a neighbouring site, Swartkrans. As Sherwood (2013) is not intended for separate publication, this chapter includes the methods in detail. This chapter is formatted as a journal paper which is intended for submission following thesis reviews. However, the relevant parts of the literature review will be added to Chapter Three before submission of a journal paper. This has been done to avoid repetition, as there is a separate chapter (Chapter Two) in the thesis which extensively discusses the available literature. Chapter Four consists of a published paper which investigates raw material selection for Middle Pleistocene artefacts from Terrace Three of the Han River in the DRR, central China. This paper in particular shows the importance of experimental knapping of the relevant raw material studies, as much of the selective decision process employed at this site was understood in more depth after extensive knapping of the available materials. Chapter Five consists of a published paper for the DRR, which investigates the rare presence of bipolar flake blanks being used during the Acheulean for the creation of LCTs. Experimental knapping was conducted to help understand why this is the case and to identify unique features that can be used to identify which LCTs were created on bipolar flake blanks. Chapter Six provides the overall discussion and conclusions of the thesis. The research questions presented above are discussed, comparisons with previous raw material studies are made, and general conclusions are drawn about hominid behaviour through time.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

Rock properties play an important part in creating functional tools (Andrefsky 1994; Brantingham *et al*. 2000), as the quality of a particular rock relates to its flaking predictability, the durability and sharpness of the knapped tools (Braun *et al*. 2009; Wadley and Kempson 2011), and thus its usefulness for performing tasks. Therefore, gauging all aspects related to raw material selection is very important in understanding to what degree hominids understood the various properties of rock and how these affected tool creation and use. This chapter will cover previous raw material studies and discuss various behaviours documented for hominids from the inception of tool creation to modern day times for comparison. It also shows the various types of studies done on raw material studies. The chapter is divided into three time periods and discusses hominid and human behaviours with regard to all types of raw material selection that is documented in the archaeological record. The MSA and LSA are included to show the studies done on raw material selection during these time periods and, most importantly, to show that human adaptability and selective complexity extends to other materials. This is to place lithic raw material selection into the broader context of raw material selection behaviours.

## 2.2 Raw material selection and behaviours during the ESA

Studies on raw material selection during the Lomekwian have not yet been done in detail. Tools dating to 3.3 Ma uncovered at Lomekwi 3 in West Turkana, Kenya, were made from igneous rock that is locally available, making it uncertain if these rock types were specifically selected for. However, selection for the size of cobbles might have been practiced as larger cobbles were often used from the local sources, which had a variety of cobble sizes available (Harmand *et al*. 2015). The selection of rock during the Oldowan from 2.6 Ma has been assessed in detail for assemblages in East Africa (Isaac *et al.* 1997; Semaw *et al*. 2003; Stout *et al*. 2005; Braun *et al*. 2009; Harmand 2009; Stout *et al*. 2010; Goldman-Neuman and Hovers 2012; McHenry and de la Torre 2018). A recent paper documenting the earliest Oldowan assemblage in Ethiopia, at 2.61- 2.58 Ma (Braun *et al*. 2019), indicates selection for specific types of rock and better qualities of these rocks (predominantly rhyolite) was already

present during the early Oldowan. These papers show that early hominids were already capable of selecting for suitable materials to be utilised for stone tool making, as selection was practised for rock types that were durable, finer grained and with fewer visible flaws present. Hominids also tended to select for the size and shape of a rock, as the shape of the rock intended for knapping influences the type of tools that can be created with ease, or determines the amount of shaping that is required prior to tool manufacture (Goldman-Neuman & Hovers 2012). Shape can be quantified mathematically (Barret 1980; Illenberger 1991; Benn & Ballantyne 1993) or placed into general shape classes by visual assessment, which is often preferred by archaeologists. It is noted by Goldman-Neuman & Hovers (2012) that early hominids in East Africa around 2.3 Ma preferred to select rocks that have some angularity, as it allows for a starting platform for knapping. A similar preference for angularity is noted by Delagnes & Roche (2005), who reconstructed cores from Lokalalei 2C in Kenya, and by Kuman (1996) and Field (1999), who conducted experiments to evaluate the reduction of certain shapes into cores for the local rocks at Sterkfontein, South Africa. The angularity, rather than the general shape of a rock is important because angularity allows for platforms with angles below 90 degrees, which according to Delagnes & Roche (2005), is the most important selection factor for rock shape during the Oldowan.

However, shape and size were not the only determinants of rock selection, as certain rock types were favoured by ESA hominids. These rock types (certain igneous material, chert, quartz and quartzite) are abundant, and they can often produce durable and sharp-edged tools that are more effective. Selection for better qualities of these rock types was also practiced at some sites. Stout *et al*. (2005) assessed six of the earliest sites from Gona, of which five date to between 2.6 and 2.5 Ma, whilst one site dates between 2.58 and 2.27 Ma. Samples from the local conglomerates available to the hominids were collected and analysed with variables listed below. The data were captured directly from cobble surfaces and were compared to the artefacts from each site. The authors examined rock type, percentage of phenocrysts present (area occupied by large crystals embedded in a fine-grained matrix), average size of phenocrysts, and groundmass texture (the size of the grains surrounding the phenocrysts). The majority of artefacts was finer grained than the rock samples collected from the conglomerates and also had smaller and fewer phenocrysts present. This study showed that selection of rock quality by late Pliocene hominids was indeed present in Gona at the beginning of the Oldowan and not random. If selection was random the assemblage would exhibit similar properties to the average of rocks found in the conglomerates. Goldman-

Neuman and Hovers (2012) used a similar approach to Stout *et al*. (2005) for assessing rock quality for the Oldowan in the Makaamitalu Basin, Hadar, Ethiopia. Two sites were assessed, one site dating to about 2.36 Ma, and one being slightly younger, based on stratigraphic considerations. Selection at the older of the two sites was mainly for homogenous material, while selection at the younger site was towards finer grained material with fewer phenocrysts present. Braun *et al*. (2009) tested if certain engineering techniques would be sufficient to determine rock quality selection for the Oldowan in Kanjera South, Kenya, which dates to between 2.3 - 1.95 Ma (Plummer 2004). This was done by applying both engineering and experimental methods to gauge edge durability and fracture predictability. Edge durability of the various materials available was assessed by the creation and experimental use of flakes. The flakes were used in a standardised experiment with a set number of strokes in various butchering activities. The percentage of area lost on flakes was calculated for each rock type and correlated with an American standard abrasion hardness test (ASTM C241) performed on the various rock types. Fracture predictability was measured using a rebound hammer (Schmidt hammer) on conglomerates that were cut into $10cm^3$ blocks to measure a rock's ability to absorb impact energy. These results were correlated with artefacts by making use of the Brantingham *et al.* (2000) method to determine impurity encounter rates on artefacts, by counting flake scars on a tool that exhibited flaws and dividing that by the total number of flake scars on that tool. The authors concluded that certain engineering techniques could be useful to help determine the degree of selectivity practiced by hominids as there was a high correlation between engineering techniques and experimental methods. The results indicated that hominids at Kanjera South preferred rock types that were both durable and predictable when flaking (Braun *et al*. 2009).

Raw material selectivity has also been demonstrated for Oldowan assemblages in South Africa. Hominids selected specific rock types, as 90.5 % of the Oldowan assemblage at Sterkfontein, Cradle of Humankind, South Africa consists of quartz (Kuman and Field 2009) (including small flaking debris). There were in fact 12 different rock types available from which they could have selected, with the majority being chert and siliceous dolomite (Sherwood 2013). This is also apparent for the Oldowan at Swartkrans (approximately 1 km from Sterkfontein), where 61.2 % of artefacts are made from quartz (Kuman *et al*. 2018). Sherwood (2013) made use of experimentally created lithics to compare to the Oldowan, Acheulean and MSA assemblages at Swartkrans. The experimental assemblages were created to represent lithic raw material quality that would be seen in an assemblage if rocks were

randomly selected. The knapping experiments also aided in the selection of variables for analyses. The impurity encounter rates (as per Brantingham *et al.* 2000), fracture encounter rates, quartzite grain sizes and weathering of tools were analysed, as these attributes were found in experiments to have the greatest influence on knapping, shaping and use of tools. The study indicated that selection for rock quality was present in all three techno-complexes, as tools were predominantly made from three rock types that were most suitable for making stone tools and had a lower percentage of visible flaws present than the representative sample (experimentally created tools). The experimentally created sample consisted of tools made from the local geology to represent what the average quality of tools would be like if rocks were randomly selected from the landscape. This study also shows a progressive increase in selective practices towards better quality rock from the Oldowan to the MSA, as the same three rock types are selected in all three techno-complexes, yet there is a marked increase in the qualities of the individual rock pieces selected for tool creation through time (Sherwood 2013).

It is important to understand the interconnectivity between rock selectivity and habitat, and how this affected hominid technology and decision making (Braun *et al*. 2008b; Harmand 2009). Behaviours can be ascertained by studying landscape use and mobility, which is often done by determining transport distances of selected materials and tools, as well as potential stockpiles in the form of manuports. Oldowan hominids did not frequently transport rocks over large distances (>50 km), as is evident for some Middle Stone Age (MSA) sites (Merrick and Brown 1984; Nash *et al*. 2013; Nash *et al*. 2016). Sourcing was generally within a 10 km radius (Negash *et al.* 2006) and may not have been as extensive during the Oldowan, because hominids preferred closed habitats, most likely because of the abundance of plants for food, and for protection from carnivores and shelter (Sikes 1994). Furthermore, according to Hay (1976: 180), "archaeological sites are found principally in lithofacies with evidence of perennial supply of fresh water and relatively abundant game and vegetation". Many studies of Oldowan sites in East and South Africa corroborate this statement (Hay 1976; Toth 1985; Peters and Blumenschine 1995; Semaw 2000; Avery 2003; Stout *et al.* 2005; Kuman 2007; Goldman-Neuman and Hovers 2012; Sherwood 2013; Prassack 2014). Importantly, the majority of these sites is near gravels, which could indicate that hominids also occupied areas close to water not just for food and water, but also for rock sources. Rivers, especially, offer cobbles of various shapes and sizes and a variety of rock types, which provide many selective options for hominids (Kuman 2003). Multiple Oldowan and

Early Acheulean sites also contain manuports (Potts 1988, 1991; Kuman 1996; Field 1999; de la Torre *et al.* 2003; Plummer 2004; Kuman 2007; Kuman and Field 2009) from a variety of sources (Braun *et al*. 2008b), which suggests that hominids had foresight and planned for future occupations.

Hominids often implemented different knapping strategies for specific rock types, such as bipolar reduction of quartz (Diez-Martín *et al.* 2011; Gurtov and Eren 2014; Manninen 2016). (Barham 1987: 49) discusses why the bipolar technique was often implemented on raw materials such as quartz and similar siliceous materials. This technique was used on resources that are good quality for tool creation but scarce, and often in a form that is not easy to flake with freehand percussion, such as small spherical nodules of quartz. This technique is also seen around 2900-1600 BP (albeit, modern humans refined this technique) in the eastern Mojave Desert where sources of Jaun Obsidian were often in the form of spherical cobbles approximately 4cm in diameter (Torres 1998). Furthermore, flake and tool morphology can be affected by raw material type and not just the size of nodules (Dibble 1985; Manninen 2016). Quartz, which is frequently used during the ESA, often fractures unpredictably and can shatter into multiple fragments. This is especially true when trying to produce thin flakes. Knappers avoided this by making thicker flakes or using certain knapping techniques, such as bipolar anvil reduction to obtain thinner flakes (Manninen 2016). Early hominids also used certain rock types for particular tools, such as quartzite for heavy duty tools and quartz and chert for smaller tools during the Acheulean in the Sterkfontein valley (Kuman 1996; Field 1999; Sherwood 2013). This behaviour is also seen at the Acheulean site Garba XIII, Ethiopia (1-0.8 Ma), where obsidian and porphyritic rock is used for large cutting tools (LCT) production, and basalt for flakes (Gallotti *et al.* 2014). The paleochannels rarely preserve large enough cobbles for the creation of large flake blanks, which were used for LCT creation. Flake blanks were thus likely gathered at the obsidian and porphyritic rock outcrops. Cobbles were selected from the channels for the creation of the flake tools, thus two types of *chaîne opératoires* exists at this site. Adjustment of knapping techniques to certain materials, as well as utilising specific rock types for particular functions, further show that ESA hominid technological repertoires were sensitive and intricate.

Raw material selection at Acheulean sites has not been assessed to the same extent as for the Oldowan, with most of the research focussing on raw material effects on handaxe shape, size and variation (Sharon 2008; Eren *et al*. 2014). However, McHenry and de la Torre (2018)

assessed lithic raw material quality for two assemblages at the Oldowan-Acheulean transition in Bed II of Olduvai Gorge, Tanzania. One late Oldowan site (HWK EE) and one early Acheulean (EF-HR) site were selected. Artefacts were divided into rock type groups using hand-sample examination with a hand lens, which were further subdivided based on other characteristics (such as grain size, colour, mineralogy, and vesicularity). Geochemical and mineralogical analyses were applied to volcanic raw material to subdivide these into groups. This was also done on a small sample of un-modified artefacts to represent the archaeological assemblages. Selection at the late Oldowan site HWK EE was not based on rock texture. But more importance was placed on blank shape and availability of natural angles suitable for flaking. The Early Acheulean site EF-HR indicated that hominids selected high-quality fine-grained lavas for the production of LCTs (McHenry and de la Torre 2018).

It is noted that for most Acheulean sites in South Africa raw materials that were utilised were often sourced close to the site, within a 10 km distance (Klein 2000). However, see Deacon and Deacon (1999) and Braun *et al.* (2013) where sources used at Elandsfontein in the Western Cape of South Africa, may have come from 30 – 40 km away. Stone tool technologies change during this time period with the addition of LCTs. This technology remains typically standardised across the world, which could be due to a number of factors, such as social interactions and networks (McNabb *et al.* 2004) or controlled via genetic memory (Corbey *et al.* 2016).

Selection for the quality of raw material increased during the Acheulean, relative to the Oldowan, and further increased during the Middle Stone Age (MSA), as was determined by Sherwood (2013) for Swartkrans in the Cradle of humankind, South Africa. The assemblages (Oldowan, Acheulean and MSA) at this site were made from the same four rock types, but showed a significant increase in the materials quality over time, thus documenting an increase in complexity with regards to raw material selection over time in this part of the world.

Another behaviour that is seen during the Acheulean include the use and control of fire. In Africa bone burnt in campfires at the surface was discovered at Swartkrans dating approximately 1 Ma (Brain and Watson 1992; Brain 1993), and *in situ* burning is argued at Wonderwerk cave, northern Cape, South Africa (Berna *et al.* 2012), dating to 1.1 Ma. The earliest evidence of the use of fire outside Africa is found in Israel dating to 0.8-0.7 Ma at the

site of Gesher Benot Yáaqov (Alperson-Afil *et al.* 2007; Alperson-Afil and Goren-Inbar 2010).

### 2.3 Raw material selection and behaviours during the MSA

It is argued by McBrearty and Brooks (2000) that modern human behaviour gradually makes its appearance in the archaeological record around 250 – 300 ka. This is visible in many MSA sites in the ways people selected and utilised raw materials. Technologies changed drastically during the MSA, seeing the introduction of prepared core technologies, blades, points and composite tools. In addition, a general increase in geographical range is seen at multiple sites, where some resources are selected from distances over many hundreds of kilometres. Raw material types other than stone, such as bone, were used more frequently and often for specific tasks. Other behaviours are also more apparent, such as specialised hunting, long distance trade, heat treatment of stone, more use of soft hammer percussion, the use of pigments, art and symbolism.

As mentioned above the onset of the Middle Stone Age (MSA) shows a drastic change in technology. This is often believed to be related to differences in foraging strategies and raw material procurement, as more exotic (further than 40 km away from a site) rocks were often selected or traded during the MSA (Ambrose & Lorenz 1990; Ambrose 2002, 2006; Nash *et al.* 2013; Lengyel 2015; Nash *et al.* 2016; Carter *et al.* 2018; Gendron *et al.* 2019), but not always (See Brantingham *et al.* 2000; Ekshtain *et al*. 2014; Wilkins 2017). This is evident for White Painting Shelter in the northern Kalahari Desert, Botswana, where silcretes from over 220 km away were preferred over closer sources of this material (Nash *et al.* 2013). Such long-distance transport of raw material is a widespread occurrence for this region as it is apparent for three other sites in the area. Silcretes were present in assemblages from Rhino Cave, Corner Cave, and ≠Gi that were transported from as far away as 295 km, as determined via geochemical signatures (Nash *et al*. 2016). The closer sources of silcretes were of equivalent quality, and thus it is possible that the silcretes used may have been acquired through trade (some pre-knapped). Therefore, complex social interactions with surrounding groups of humans might have existed. However, Middle Pleistocene foraging strategies at Kathu Pan 1, Northern Cape, South Africa, indicate that change in foraging strategies might not have been the initial drive in technological change (Wilkins 2017). Raw materials from

the transitional Fauresmith bearing Stratum 4a (which dates to ~500 ka) were compared with the underlying Stratum 4b (Acheulean assemblage), showing that foraging strategies were similar during both these time periods. This suggests that different raw material selective strategies did not necessarily drive the technological innovations of the MSA and that the change in technology might have later driven increase selection for better quality stone. Nevertheless, the materials at Kathu Pan 1 were utilised differently and it is apparent that the occupants who created the Fauresmith technology strategically exploited the natural banding in the banded ironstone to create tools.

Raw material sourcing behaviours can be assessed by making use of a source attractiveness equation, created by Wilson (2007), which considers multiple variables that influence the choices humans had when selecting lithic resources, such as raw material quality, distance to source, size of raw material pieces and terrain difficulty. These factors are weighed up against one another and reduces these factors to a number that indicates a source's usefulness. This model was tested on the site Bau de l'Aubesier in southern France (assemblages dating from 200-100 ka) by Browne and Wilson (2011) with the inclusion of additional variables accounting for calories expended traveling to sources. The results suggest that early humans were more inclined to use source locations that had high quality material and had plenty raw material present, normally with large pieces. Sources that were hard to get to, resulting in more energy cost, were generally avoided. Early humans at Bau de l'Aubesier optimised their raw material sourcing to get the best quality goods for the lowest amount of time and energy spent in procuring it. The authors note that this model does not account for all factors involved in raw material procurement, such as trade networks, need for other resources or hunting strategies. However, the models "have yielded important insights into the geologic and geographic factors that mattered to the prehistoric groups" of Bau de l'Aubesier and "contribute to developing a better understanding of the overall picture, including other aspects of their organization of economic behaviour" (Browne and Wilson 2011: 606). The results were obtained for the site as a whole (all archaeological layers), thus the results reflect the overall tendency of early humans occupying the area through that time period (200-100 ka). This model was later applied to further test behaviour at Bau de l'Aubesier by Wilson and Browne (2014) on 11 archaeological layers. The lower six layers indicated that raw material selection was more heavily influenced by terrain characteristics, than raw material characteristics, for determining source locations. The reverse is, however true for the upper five layers. It should be noted that both terrain and raw material characteristics had an

influence in determining source locations for all layers, but were weighted differently. The change in the upper layers are likely due to a change in subsistence as the climate became much cooler during the late Middle Pleistocene.

Energy expenditure is certainly one of the most important aspects of raw material selection to consider. Selection for rock that is not the absolute best quality (such as flint and obsidian) to make stone tools, does not by itself suggest that hominids were not behaviourally complex. Many late Middle Pleistocene sites in Germany show the abundant use of flints for the creation of lithics. However, quartzite tools made in central Germany during this time period are not studied in as much depth as the assemblages made from flint, which is considered the better-quality material to use. Sternke (2007) suggest that people occupying this region likely had a very localised social network that did not extend as far north to the flint sources (75-85 km away). Extended networks often require a high investment of energy and people might simply not have needed to make such efforts. The raw material constraints did not merit it, as the local quartzite performed well enough for tool manufacture and use. This is likely also the case with the Nöstvet axes in south-eastern Norway during the Late Mesolithic (6300 - 4000 BCE). Axes were made from basalt, hornfels or diabase instead of flint, which is considered a better-quality material. Flint materials were not readily available and would have required intense selection or trade networks to acquire. Eigeland (2007) experimentally replicated axes from these materials and indicated that the people likely preferred these materials rather than using them as supplements to flint. These materials require skill and practice to knap as they have a lower flaking predictability than flint. However, these materials are very durable and hard and will likely last longer under heavy duty tasks, thus investing time and energy into mastering knapping of these materials was likely preferred.

Raw material quality does not necessary impede a knapper's skill or prevent the improvement in their skill, as was tested by (Eren *et al.* 2011). Experimental knapping of preferential Levallois cores from two sets of raw material was conducted, one from large flakes of uniform chert with little internal and external flaws, and a more challenging material made from irregular chert nodules found in limestone, where parts of the nodules grade into limestone and the occasional flaw (void, concretion or cleavage plane) can be encountered. The knapper's skill was measured and determined by the knapper's ability to reach a set of predetermined goals. The first batch of experimentations was conducted with the good quality chert and then the knapper would switch to the second batch of the more challenging

material. The switch to the more challenging material did not impede the knapper's ability and they adapted to the material and consistently removed "larger, more symmetrical Levallois flakes that consumed more of the core's upper surface, without overshooting the rim" (Eren *et al.* 2011: 2738). This study shows that the quality of a material does not necessarily restrict a knapper's ability to grow their skill level. If anything, poorer quality material might help improve a knapper's abilities, as it puts their skills to the test. The poorer quality material did yield more debitage due to more shaping work required, thus high amounts of debitage is not necessarily a reliable indicator of a knapper's skill. Additionally, tool morphology is not as drastically affected by raw material quality as first thought, as confirmed by Eren *et al.* (2014), with experimental replication of handaxes made form basalt, obsidian and flint, by the same knapper. Statistical tests indicated that the resulting handaxes show little variation in shape and size overall.

The above studies indicate that multiple factors influence raw material selection, one of them being the quality of rock. MSA people, like the ESA hominids, selected not only for particular types of rock, but sometimes also the qualities of these types of rock. This is apparent for the Howieson's Poort Industry at Klasies River Mouth (KRM) as there is a noticeable increase in fine-grained rocks that were gathered from distances over 40 km away (Ambrose 2002, 2006). Silcretes from this site were classed into coarse-and-fine grained varieties by Singer & Wymer (1982), which indicated that finer grained varieties were selected over the coarser ones. This was later confirmed by Villa *et al*. (2010) who created three categories according to the sorting and sizes of grains. The above studies took a more qualitative approach to access the qualities of the silcretes used at KRM, but other more quantitative techniques to access raw material selection during the MSA was employed by Wadley and Kempson (2011), who made use of engineering and geochemical testing to assess raw material selection for MSA lithics from Sibudu, KwaZulu-Natal, South Africa. The authors tested hardness, surface roughness and fracture toughness for the two predominant rock types found in the assemblages, hornfels and dolerite/diabase. Hardness tests are used to determine how durable certain raw materials are and measured using a Vickers Hardness Test, which tests the force a material can withstand before deforming. A pyramid shaped diamond is pushed onto the surface of a specific raw material with a predetermined force. The area of the indent made by the diamond is then measured to give a Vickers hardness value, which if low indicates a durable material. The Surface roughness of materials was determined by calculating the average grain size of that particular rock from

thin sections, the larger the grains the higher the surface roughness. Fracture toughness was also determined by making use of a low energy Charpy pendulum impact testing machine, which measures the amount of energy a material absorbs before it fractures. The rock types are cut to specified dimensions and impacted by a swinging pendulum of certain weight from a set height. The device then measures the amount of energy the sample absorbs upon impact. The tests revealed that dolerite had a higher durability than hornfels, but was coarser grained. Dolerite is difficult to knap due to its hardness, but it ensures edges that will last, whereas hornfels is much easier to knap, but requires re-sharpening more often. The people at Sibudu often selected both of these materials, which varied with intended use of a tool (Wadley and Kempson 2011).

Moník and Hadraba (2016) also made use of engineering methods to determine aspects of rock quality, with regards to different flints and cherts used by Early Upper Palaeolithic (50-30 ka) populations in Moravia, Czech Republic. They used the Charpy V notch-impact test, as well as testing the micro-hardness using the Z2.5/HU0.2 (Zwick/Roell, Germany) indenter. Two types of flints were tested, erratic flints (EFs) and Krumlovský les I type chert (KL I). The EFs were tougher (does not break) under low velocity impacts than the KL I cherts, but under high velocities the KL I cherts were tougher. The results indicated that erratic flints were easier to knap with soft hammer percussion, which made it possible to acquire thin blades and bladelets. KL I cherts, however, was the favoured material for the creation of leaf points in Moravia, likely due to its ability to withstand higher impacts.

An innovative methodology was devised by Brantingham *et al.* (2000) to assess rock quality for a late Pleistocene site (Tsagaan Agui cave Lower Grotto) in northeast Asia, Mongolia, by determining the impurity encounter rates encountered on artefacts. The number of flake scars on all surfaces of an artefact that exhibited an impurity, such as a void or crystalline inclusion greater than 1cm (ISCAR), was divided by the total number of flake scars on that artefact (DSCAR), and multiplied by 100 to get a percentage. The majority of artefacts from this site had some impurities present with more than half of the artefacts having an impurity encounter rate of 40 % and above. This means that for every ten flakes removed, four would encounter an impurity or major flaw. However, despite the flaws present in the banded chert utilised at this site the people simply adapted by adjusting their flaking strategies rather than sourcing better quality materials from further away or trading. Perhaps this was not possible or the technologies were made for expedient uses or season occupations.

These studies show the remarkable ability early humans had to adapt, by changing the ways they use and/or knap raw materials during times when raw materials are scarce. This results in much technological variation across many MSA and Later Stone Age (LSA) sites around the world. When considering technological variation, it is often decided that either raw material or cultural variation comes to play a role in this variation. It is often a combination of the two, as suggested by Groucutt *et al.* (2017). This is seen in the case of a small rockshelter (CA SBr-6055) dating from 2900 - 1600 BP in the Mojave Desert (Torres 1998). Earlier occupations at the site show the use of larger obsidian pieces that were knapped via the freehand percussion technique, whereas later occupation at this site reduced obsidian from the Juan source differently, utilising bipolar reduction of small obsidian nodules. This change may have been driven by larger clasts of obsidian becoming scarcer over time, as modern-day surveys show fewer large clasts still available from the source location. However, this change may also have been driven by a change in hunting techniques. People started to manufacture arrow points, but the local cherts were of such poor quality that it required extensive reduction to create usable arrow points. The small obsidian clasts from the Juan obsidian source, however, could produce multiple arrow points via bipolar reduction, as was determined by Torres (1998) with experimental replication of the technology. It is also easier to knap smaller nodules with this technique than large obsidian clasts.

Site variation can also be attributed to changes in environment forcing people to adapt. Raw material procurement and consumption in the Kanto Plain, central Japan, prior to the Last Glacial Maximum (LGM), around 30 ka, shows more general exploitation of materials from over 200 km away by highly mobile hunter gatherer societies. During the LGM, as the environment degraded, a move towards more sedentary life styles are seen with only seasonal movements between resource rich areas and local exploitation (Kunitake 2016).

The use of different types of material, such as ivory and bone, to create certain types of tools is seen more frequently during the MSA as compared to the ESA. This also pertains to stone implements as certain rock types perform better at certain tasks than others, even if they are generally good materials to knap. This was experimentally tested by Loendorf *et al.* (2018), who created stone arrow tips from siltstone, basalt, chert and obsidian to test their effectiveness as arrow tips. They determined via the falling-weight impact tester and sample slabs which of the above mentioned materials were more elastic than others. Their effectiveness penetrating into various materials was tested by firing hafted arrows into skin,

flesh, hide and bone. Stone tips with low impact energy, such as obsidian and chert, perform well penetrating into elastic materials such as skin and flesh, but they perform poorly when impacting inelastic material such as hide and bone. The more durable materials, basalt and siltstone, perform better penetrating into hide and bone. It was also determined that the shape of arrows and their hafting techniques has an impact on performance. More such research and experimentation will help to understand why certain materials were used for arrow tips by various prehistoric people and whether arrows were made for hunting (and various animal types) or warfare.

When stone is scare or of poor-quality people also adapted by making use of other types of material. The Alutiiqs in Alaska's Kodiak Archipelago during the last 7000 years often made use of various types of bone or antler to make tools. Margaris (2014) determined antler was predominantly used for the creation of harpoon points for fishing, whereas whale bone, bird bone (and antler) were used for the creation of arrows and other pointed tools. Tools that required sudden and sharp impacts were made from antler, whereas the tools that required low, but sustained stress, were predominantly made from whale or bird bone (Margaris 2014). The use of bone tools is not unique to this site and is also present during the MSA in Africa (d'Errico and Henshilwood 2007; d'Errico *et al.* 2012) and Europe (Cristiani and Borić 2016).

Extensive trade networks of raw materials and premade stone tools are present during this time period and can be seen at the site of Damnoni southwest Crete, where nine implements were found (no debitage or cores) that were made from obsidian, which is not available on the island (Carter *et al.* 2018). Using energy-dispersive X-ray fluorescence spectroscopy it was determined that the source location of this obsidian is from islands over 200 km away, a common source for the surrounding Aegean Mesolithic sites. This study adds information with regards to maritime activities of Mesolithic hunter-gatherers and possibly complex social interactions with neighbouring societies. This is also seen in a later time period at Sistema 7 Venado, Monte Albán, Mexico around 800 BCE, where premade pieces of obsidian (sourced from between 200 – 800 km away) were excavated with no cores or nodules (Gendron *et al.* 2019). Yet other materials such as quartzite, chalcedony and flint were knapped by the local people, which "could be interpreted as a commercial or political strategy to import material from selected sources, or a technical choice to obtain a better obsidian quality" (Gendron *et al.* 2019: 590). Trade networks between early people became

very complex over time as is documented with the potlatch practiced by the Indigenous peoples of the Pacific Northwest Coast of the United States and Canada (Harkin 2001) and similar practices in Asia (Cooper 1982).

Human adaptational behaviour is also seen in the MSA by the use of heat treatment on stone to help alter raw material properties favourably (Wadley and Prinsloo 2014; Schmidt *et al.* 2015; Schmidt and Högberg 2018). The earliest evidence of heat-treated stone is seen at Pinnacle Point in South Africa around 164 – 72 ka (Brown *et al.* 2009). Evidence for heat treatment also exist in China at the Shuidonggou (SDG) site complex in Ningxia province, northwest China (Zhou *et al.* 2014). This confirms the appearance of heat treatment technology in East Asia around 32 ka, and could be evidence for the spread and distribution of heat treatment technology.

A study done by Lengyel (2015) suggests that groups of mobile humans during the MSA would often practice selection of raw materials on the move. Assemblages at Bodrogkeresztúre-Henye Gravettian site from northeast Hungary (28-26 ka) preserves high quality exotic materials not found in the surrounding Carpathian basin, which provides numerous raw materials for exploitation. This assemblage likely consists of mobile tool kits that were curated during travels, daily foraging and subsistence and discarded nearing their end (Lengyel 2015).

### 2.4 Raw material selection and behaviours from the LSA to present

Stone was not always used as tools in the traditional sense but was also used as a sign of status or hierarchy, adding more behavioural complexity to lithic raw material selection practices. Obsidian at The Postclassic Aztatlán centre of San Felipe Aztatán in Nayarit, Mexico might have been used as a sign of power. Both local and exotic sources were used and can be differentiated upon visual inspection. Pierce (2017) proposed that the more exotic obsidians were acquired and used by individuals who had greater status, thus showing their wealth and outside connections. Stone such as lapis lazuli (Rosen 1990), jade (Livingston *et al.* 2018) carnelian (So, in press), and turquoise served not only as trade commodities (Hull *et al.* 2014), but were also socially valuable objects often associated with one's identity. In the Chacoan and post-Chacoan times "ornaments played a vital role in negotiating various

aspects of personal and social identification through practices of bodily adornment and ritual deposition." (Mattson 2016: 136). A large proportion of these ornaments were made from turquoise (60 %), indicating it was often sought after. These stones had multiple functions such as trade, identity and ritual. Rare examples of jade dagger-axes made in China during the Shang dynasty ca. 1600 BCE - 1046 BCE likely served as ceremonial objects or used by the elite as ritual symbols of power and prestige" (Livingston *et al.* 2018). This indicates that spiritual reasons were sometimes behind the acquisition of specific rock types. The Maya, for example, had a complex relationship with obsidian, which they would often source from over a hundred kilometres away. It was not only used for daily activities by commoners and elites alike, but also for decoration and blade creation for bloodletting rituals in caves (Stemp *et al. 2018;* Stemp *et al.* 2019). Flint (or stone) was often associated with the Kawak (Cauac) glyph in Mayan culture and was believed to contain the power of lightning (Bassie 2002, 14).

Furthermore, selection of particular rocks was also performed for the creation of pigments and later complex dyes (Barnett *et al.* 2006; Pagès-Camagna and Raue 2016). Early pigments were often created from charcoal and ochres, which are a rocks, clays or soils that contain iron oxide or iron hydroxide minerals that can produce a coloured streak (Wadley 2010; Zipkin 2017). The colours produced are earthy and range from browns to reds, orange and yellows. These rocks are generally not great for stone tool creation as they are brittle in nature and do not flake well or hold a sharp edge (personal experimentation). The discovery of large amounts of these rocks in an assemblage indicates possible symbolic reasons for its procurement, such as at the site GnJh-15 in the Kapthurin Formation, Kenya, where over 70 pieces of red ochre dating to 285 ka were discovered (McBrearty 2001). Pigments have also been reported at the site of Twin Rivers in Zambia dating to at least 230 ka (Barham & Smart 1996; Barham 1998), but possibly as early as 300 ka (Barham 2002), and are "frequently encountered at MSA sites in South Africa postdating 130 ka" (McBrearty 2001: 92). Ochres were often sourced from multiple locations, as is seen between and within various occupational periods at Blombos Cave, South Africa (Moyo *et al.* 2016), and may have been used for spiritual or practical purposes such as forming part of adhesives to haft stone pieces (Wadley 2005). Beads made from shells (some originate 240 Km away) show signs of pigment at Bushmen Rock Shelter, South Africa (12– 8 ka). Two types of pigment recipes were used at this site, one for adhesive another for pigment (Dayet *et al.* 2017).

The use of beads brings forth the behavioural complexity of early humans, but also points out that stone and stone tools were not always used purely for survival purposes but other uses such as drills for manufacture of beads (Werner and Miller 2018). The earliest definitive evidence we have of the use of beads date to about 78 -75 ka and were made from shell of sea snails (Henshilwood *et al*. 2004; d'Errico *et al.* 2005; Vanhaeren *et al.* 2013). Later (towards the end of the MSA around 50 ka) beads were made from other materials such as ostrich eggshell (Miller and Willoughby 2014).

Procurement of rock for tools eventually gave way to other materials such as metal, but it still has meaning in today's society and is sought after more than ever before, albeit for different reasons. At present rock and rock formations are sought after for minerals and elements used for energy, technology, construction, engineering and manufacture. Valuable gems are mined and sold to consumers as these are still used for various forms of symbolism. This is also shown by the use of dimension stone in our architecture, such as marble tiles for flooring and in works of art, such as pieces in the "Collezione Medicea di pietre lavorate", a collection of carved and polished stone ornaments from the members of the Medici family since the 15$^{th}$ century (Re *et al.* 2015). In addition, even today some people tie spiritual or healing energies to certain types of rocks, gems and minerals. This behaviour is not too surprising as stone has played an important role in human evolution and history and became part of our survival for most of our time on the planet.

## CHAPTER THREE: STUDY ONE

This section is formatted as a paper for forthcoming submission to the journal Archaeometry

**Author**: Nicole Sherwood, Kathleen Kuman

**Thesis pages:** 24 - 55

Lithic quality comparisons between Swartkrans and Sterkfontein in the Oldowan and Early Acheulean, South Africa

ABSTRACT

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# Lithic quality comparisons between Swartkrans and Sterkfontein in the Oldowan and Early Acheulean, South Africa

## 3.1 INTRODUCTION

This study compares lithic raw material quality between two important ESA sites in southern Africa through analyses of impurity encounter rates (IER), fracture encounter rates (FER), weathering states, and quartzite grains sizes. In addition, it incorporates an extensive experimental aspect to support the analytic results. As noted in Chapter 1, the paper is formatted as a publication (for submission following thesis reviews). Because the methods and results from Sherwood (2013) have not previously been published, they are included here. While the original data for Swartkrans is thus incorporated from Sherwood (2013), the number of specimens analysed for the Oldowan at this site has been expanded for the thesis to provide a more robust analysis, and the data for both Sterkfontein assemblages are entirely new. The two sites in question, Sterkfontein and Swartkrans in the Cradle of Humankind, South Africa, are ideal for comparing the selection of raw material qualities in the ESA, as both sites have Oldowan and Early Acheulean assemblages present. This allows for comparisons to be made between the two sites and evaluation of change through time from the Oldowan to the Early Acheulean at both sites. Sherwood (2013) developed and applied the methodological approach used in this paper for the Swartkrans assemblages, by comparing the Oldowan, Acheulean and Middle Stone Age for this site, documenting a progressive increase in selection for better quality raw material from the ESA to the MSA at Swartkrans.

### 3.2 MATERIALS: the site, their geology, and sampling details.

Swartkrans and Sterkfontein are neighbouring sites in the South Africa's Cradle of Humankind World Heritage Site (Figure 1). They are a 1 km apart on opposite sides of the Blaaubank River. Like all of the fossil sites that make up the World Heritage Site, they are karst caves filled with fossil-and artefact-bearing deposits. Lithics and fossils were washed into the caves from the landscape through open shafts accumulating deposits forming extensive talus cones. These two sites were selected as they both have sizable Oldowan assemblages, ca 2 Ma, and three Early Acheulean assemblages, ca 1.6 to 1.0 Ma, between them (Gibbon *et al*. 2014; Granger *et al.* 2015). Their close proximity to each other allowed for the tools from both sites to be made on raw materials from the same surrounding geology and the same gravels source. This makes it possible to compare the differences and similarities in rock quality selection between sites of similar age in similar geological contexts, as well as through a window of time between ca 2 and 1 Ma. Both sites also contain MSA tools. The Swartkrans MSA derives from a colluvial deposit <110, 000 years old (Sutton *et al.* 2009); however, the MSA from Sterkfontein is a small sample of artefacts in poor stratigraphic contexts (Reynolds *et al.* 2007), and thus the MSA is not included in this paper.

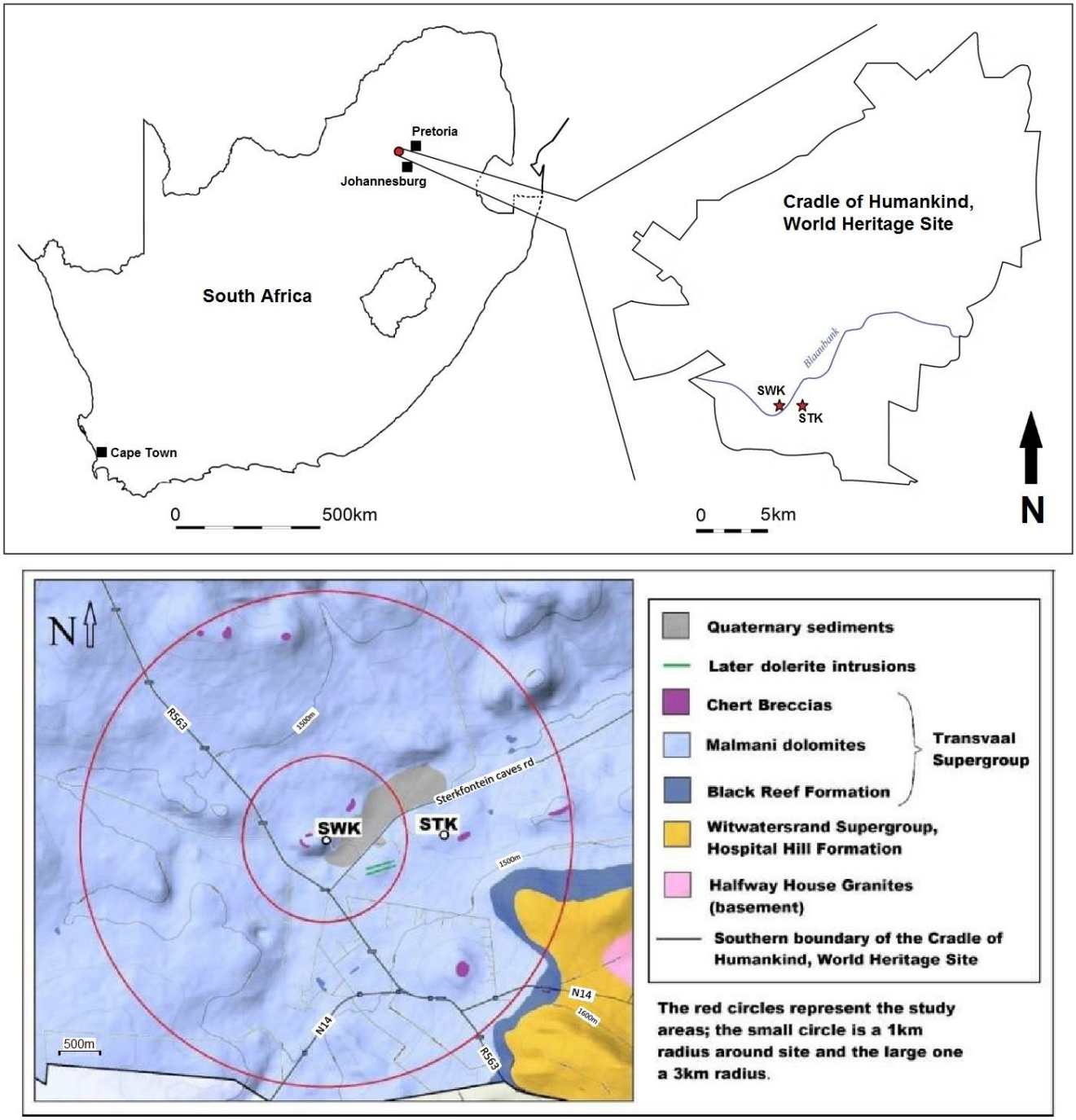


**Fig. 1.** The location of the Cradle of Humankind World Heritage Site showing the two major sites Swartkrans (SWK) and Sterkfontein (STK), as well as the geology surrounding the sites. (Adapted from Sherwood {2013}).

*3.2.1 Swartkrans*

Over the last 65 years, this site has produced many animal and hominid fossils (early *Homo* and *Paranthropus*), as well as cut- and percussion-marked bone showing hominid processing of some of the fauna from three Early Pleistocene geological members that also contain Oldowan and Early Acheulean assemblages (Brain 1993; Clark 1993; Field 1999; Pickering *et al*. 2008; Sutton 2012). In addition, the site has been argued to contain some of the earliest evidence for the controlled use of fire at 1 Ma (Brain and Sillen 1988). Swartkrans contains five members, but the Oldowan lithic assemblage is present only in the Lower Bank subunit of Member 1. Member 1 also includes a slightly younger sub-unit (the Hanging Remnant). The faunal age estimate for the entire member was originally published as ca 1.8 - 1.6 Ma (Vrba 1985). Subsequently, U-Pb dating by Pickering *et al*. (2011) on two flowstones capping and underlying the entire member provided dates of >1.7 Ma and <2.25 Ma. Most recently, dating by Gibbon *et al.* (2014), using the cosmogenic nuclide burial method on sediment and a quartzite manuport, has provided dates of 2.19 ± 0.08 and 1.8 ± 0.09 Ma for the Member 1 Lower Bank, consistent with the older dates for this deposit. Members 2 and 3 both contain Early Acheulean artefacts, with Member 2 dated to ca 1.5 Ma via biochronology (Vrba, 1985; Churcher and Watson, 1993), and Member 3 now well dated to ca 1 Ma (Gibbon *et al.* 2014).

The Swartkrans Oldowan Sample used in this study derives from excavations of the Member 1 Lower Bank directed by Travis Pickering from 2005 to the present (Kuman *et al*. 2018). This assemblage consists of 1849 pieces, but only pieces 2 cm or larger in maximum length were chosen for this study as little information can be gained from small flaking debris (SFD, <2cm), apart from details of assemblage preservation. In addition, manuports were not included as they were not knapped or utilised. The sample available without SFD and manuports is therefore 712 artefacts, of which 692 were analysed (Table 1). This sample consists of data from Sherwood's MSc (Sherwood 2013) as well as an additional 78 pieces. These are the remainder of all artefacts in the assemblage excavated since 2005, with the exception of a small number of pieces that were either extensively stained or weathered, such as the 13 artefacts that were made from diabase.

The Swartkrans Acheulean sample in this study samples pieces from Members 2 and 3 excavated by C.K. Brain from 1965 and 1986, which includes 687 pieces identified by Field (1999) as artefacts (462 pieces without SFD and manuports). A total of 112 pieces from this

set were sampled at random for the Swartkrans Acheulean (Table 1) from both Members 2 and 3. The selected pieces from both members were combined, which could be done as the data for them were similar and not statistically different. All Swartkrans lithic material, including that excavated by Brain, is now curated in the School of Geography, Archaeology and Environmental Studies at the University of the Witwatersrand.

**Table 1:** Sample sizes

| Sample No. | Swartkrans | Sterkfontein | Experimental |
|---|---|---|---|
| Oldowan | 692 | 255 | 1674 |
| Acheulean | 112 | 67 | 843 |

*3.2.2 Sterkfontein*

Sterkfontein is well known for its hundreds of specimens of hominid fossils (*Australopithecus* in the older members and a small number of early *Homo* and *Parathropus* fossils in younger members) and large assemblages of faunal remains. The Sterkfontein deposits are contained in six original members named the Sterkfontein Formation (Partridge 1978), a Post Member 6 infill (Kuman and Clarke 2000), the Jacovec Cavern (Partridge *et al*. 2003), and the Lincoln Cave (Reynolds *et al.* 2007). Member 5 (M5) contains the Oldowan and the Early Acheulean assemblages (Kuman 1994). The Oldowan is present only in the eastern section of M5 East, below a depth of 22 feet (Kuman and Clarke 2000). The most recent dating of the Oldowan in M5 East is based on a cosmogenic burial age for a manuport and places it at 2.18 ± 0.21 Ma (Granger *et al.* 2015), which is consistent with a faunal age estimate of ca 2 -1.7 Ma (Kuman and Clarke 2000). The sample used for this study comes from excavations of Member 5 East by R.J. Clarke and published by Kuman and Field (2009) as 3513 pieces. As the majority of these pieces is SFD, 255 artefacts were randomly chosen for study from 556 pieces 2cm or larger in size (Table 1).

The Acheulean is present in M5 West and also in M5 East above 22 feet in depth (Kuman 1998; Kuman and Clarke 2000). However, the context of the M5 East deposit has been disturbed above 22 feet with solution pockets that have admitted some younger (largely MSA) material (Kuman 1994; Kuman and Clarke 2000). Thus, only artefacts from Member 5

West were analysed in this study, with the exception of seven LCTs from other squares in the site judged to be in better context (see Kuman and Gibbon 2017). The Acheulean-bearing M5 West is estimated at 1.7 - 1.4 Ma (Kuman and Clarke 2000; Kuman 2007) and was excavated by Alan Hughes during the 1970s -1980s and then by R.J. Clarke from the 1990s. The number of Acheulean artefacts randomly sampled for analysis is 67 (Table 1) of 247 artefacts within an assemblage of 398 pieces (with SFD and manuports).

*3.2.3 Experimental sample*

In addition to two sets of Oldowan and Acheulean artefacts in this study, a large experimental assemblage was created for comparison of flaking properties and for testing in use. This allowed for the attributes of each raw material type to be assessed (see section 3.3.3). Each knapped rock and its detached elements were placed in individual sample bags. From this bag, the core (or LCT) was taken, two chunks, and three flakes, all chosen to best represent the entire rock. One of these flakes was then lightly retouched to replicate a formal tool. In cases where the core had shattered during knapping, one of the core chunks was taken instead. In some cases, rocks were so badly weathered that most of the knapped material resembled natural pieces or disintegrated pieces. Thus, only pieces that had characteristics of being knapped were taken for data from these rocks, but these would often not provide many flakes and few that would allow retouch or use. All of these pieces were analysed with the variables set out in this paper and two databases were created. The experimental Oldowan assemblage included cores, flakes, chunks and retouched pieces, whereas the Experimental Acheulean assemblage also included LCTs. The Experimental samples were created to represent the type of tools that can be found in each of the two techno-complexes (Oldowan and the Acheulean). Flakes, chunks, cores and retouched pieces are found in both the Oldowan and Acheulean, but LCTs are only found during the Acheulean. Tools, like the LCTs cannot be made from terrible material, as the process often fails. Therefore, to have a representative experimental sample for the Acheulean a separate set of data was created that incorporated LCTs. This brought the percentage of flawed material down a bit for the Acheulean experimental sample, as few LCTs could be made from poor raw materials, thus giving a more representative experimental database to compare with the archaeological assemblages from the Acheulean. The data for the experimental Oldowan pieces consisted of 811 pieces created for the MSc project (Sherwood 2013), plus with an additional 863 pieces

for the PhD study. Thus, the Oldowan experimental sample was more than doubled in the current study. The experimental Acheulean assemblage consisted of 843 pieces, from Sherwood's MSc.

### *3.2.4 Geological considerations*

The geology of the study area was formed by two separate shallow marine basins, namely, the Witwatersrand Basin (Eriksson *et al*. 1981; Winter and Brink 1991; Beukes and Nelson 1995; McCarthy 2006), consisting mainly of quartzite formations, and the succeeding Transvaal Basin (Eriksson *et al*. 2006), consisting primarily of dolomitic limestone and chert formations (Figure 1). A small portion of the lower Witwatersrand Supergroup is located southeast of Sterkfontein, with the rest of the geology in the study area belonging to the Transvaal Supergroup. Hence the foundation geology of Swartkrans and Sterkfontein consists primarily of dolomites and cherts with age ranges from 3 billion years ago (Robb and Meyer 1995) to approximately 2 billion years ago (Eriksson and Clendenin 1990). Many structural changes have occurred within the deposits over time, such as fluid movements (Phillips *et al*. 1990), extensive faulting (Stanistreet *et al*. 1986; Roering and Smit 1987; Stanistreet and McCarthy 1991; Reimold 2006; Dankert and Hein 2010) and ensuing metamorphism. There are also occurrences of other structures in the dolomite and chert due to their depositional nature, such as ooids (Button 1973; Eriksson and Clendenin 1990; Eriksson *et al*. 2006), tidal ripples and stromatolites (Eriksson 1977, Walter *et al.* 1974). Twelve different rock types are available in the study area (dolomite, chert, quartzite, arkose quartzite, vein quartz, slate, shale, banded iron, dolerite, breccia, ferricrete and flowstone) and numerous sub-varieties and qualities of each. The Oldowan and Acheulean archaeological assemblages from both sites consist primarily of four of the available rock types, namely: vein quartz, quartzite, chert and dolerite / diabase (classified as igneous by Field {1999} and Sutton {2012}). Some of the tools were made from quaternary gravels (Field 1999; Sutton 2012; Sherwood 2013), which lie at the foot of the Swartkrans cave and near the tourist entrance to the Sterkfontein site, just across the road from Swartkrans. These gravels are also derived from the local geology of the two above mentioned basins (Kuman 1996). The quaternary sediments include a range of rock quality varieties for nine of the twelve rock types from the study area and would thus have been an excellent source for raw material. Moreover, the river gravels are the closest source of quartzite as the nearest outcrops are approximately 2 kms away.

For this study to be practical, the same rock types available today should have been available to the hominids 2-1 Ma. In the last 2 million years, the landscape has been eroded down by at least 6 m to the current surface (Dirks *et al*. 2010; Gibbon *et al.* 2014; Granger *et al.* 2015). However, the geology of this landscape is at least 15 000 m deep (Button 1986; Eriksson *et al*. 1993) with similar depositional periods known as sequence stratigraphy, which subdivides a sedimentary pile into cyclical sequences of "genetically related strata displaying repetitive vertical profiles and stacking patterns" (Catuneanu and Eriksson, 1999: 216). The geology of this area was created in a shallow marine environment where sea levels periodically raised and retreated, creating a stratigraphy with multiple repeating layers stacked on top of each other. This means that, even with some of the surface eroded away since 2 Ma, the geology now exposed is similar. In addition, landscapes and geological formations do not erode evenly, thus, geological members that were exposed in certain areas 2 Ma have since been eroded away or potentially buried. However, similar geology from those stratigraphic layers should be exposed somewhere else on the landscape. For this reason, an area with a three-kilometre radius around each site was selected with various sample locations to ensure the selection of a large representation of the geology. Rock types from these locations were visually compared to the artefacts from Swartkrans and Sterkfontein to determine any significant differences, and none could be seen.

## 3.3 METHODS

### *3.3.1 Sampling*

The overall aim of the sampling process was to sample at least one of each type of rock that was available in each sampling location in a three-kilometre radius of Swartkrans and of Sterkfontein, and to represent what was most commonly available. For example, if chert predominantly outcrops in that location, multiple pieces of chert would be randomly sampled. The sizes of rocks were selected to be large enough to knap and to represent the artefact dimensions of Oldowan and Acheulean tools from both sites. A total of 53 sample locations (Figure 2) was selected and multiple rocks were collected at each location. Each rock was assigned a sample location number and a number for that sample, which was written on the rock and its sample bag. At each sample location a walk around the landscape determined what rock types were outcropping to get an idea of the local geology. For example, if only formations of chert and dolomite were present at a certain location, both fresh (pieces with

only surface weathering no more than 1mm in depth) and weathered pieces of the chert and dolomite were sampled. Exposed stratigraphic layers were also inspected to determine if any layers with unique features or structures were present, which would then be sampled. Rock types that were most common in a particular area were always sampled more often to represent what was most commonly available and thus more likely to be sampled randomly. The characteristics of rocks were identified visually upon sampling, with only occasional test knapping. The quaternary gravels were extensively sampled as multiple rock types and quality varieties of these were present. In addition, a test pit was dug in the quaternary sediments at the foot of the Swartkrans hill a meter down and sampled to compare with cobbles taken from the surface. Another sample was gathered near the public road entrance of the Sterkfontein site just opposite Swartkrans, where a large face of gravels was exposed up to 2 meters in depth. Rock types and sizes did not vary with depth and fresh pieces were available at all depths.

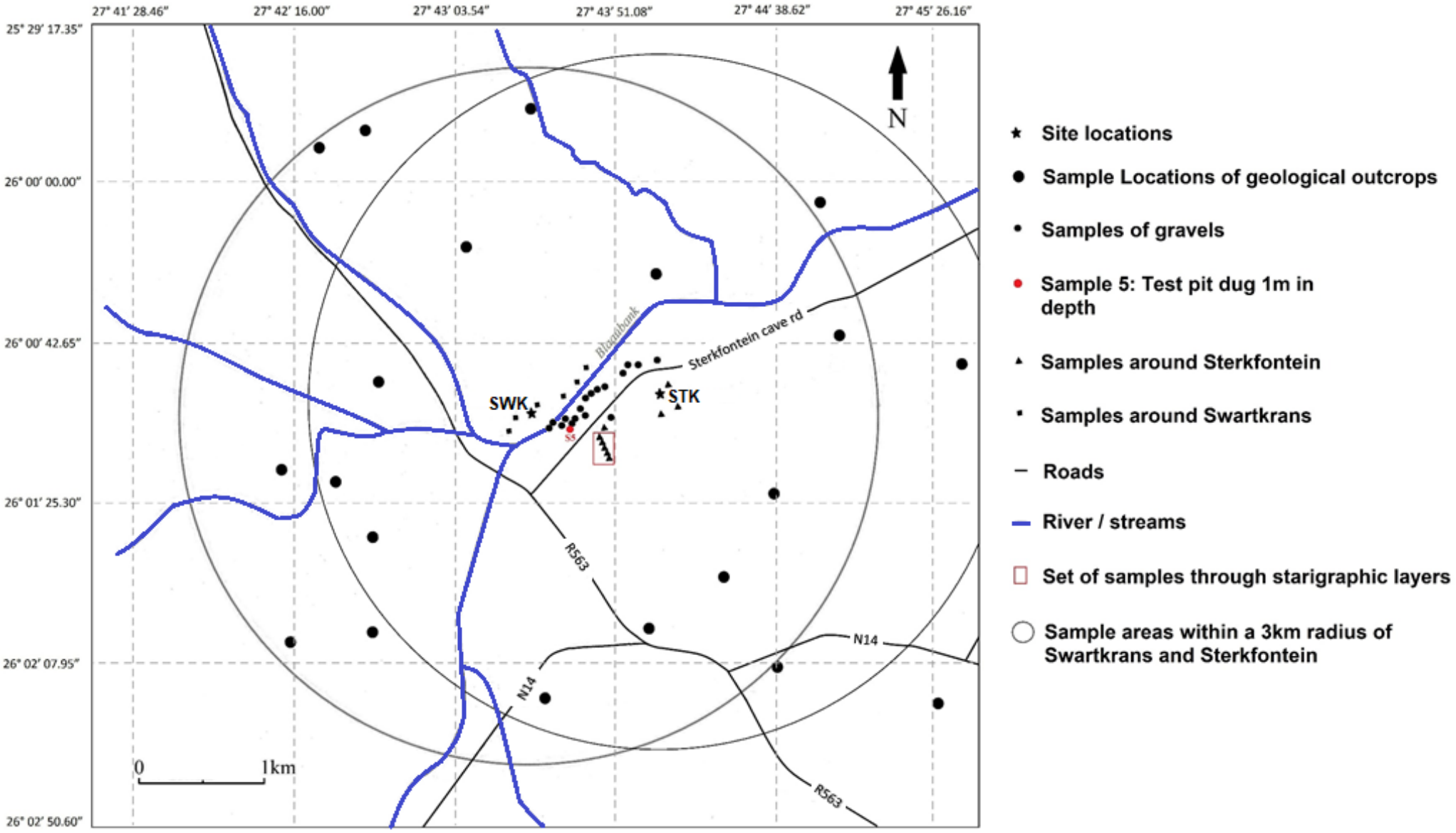


**Fig. 2.** Sample locations for the experimental knapping**.**

### *3.3.2 Knapping of the experimental assemblage*

All of the sampled rocks (N = 550) were knapped into lithic types found in the Oldowan and Acheulean from both sites. These included cores, flakes, chunks, retouched pieces and large cutting tools (handaxes and cleavers). All of the knapping was done by the first author, who has over six years of knapping experience. The knapping was done over the course of four months with periods of rest in between knapping sessions to avoid working when tired or unfocussed. All sampled rocks were reduced to typical core types within the Swartkrans and Sterkfontein core reduction strategies, and these were not always fully reduced. The rocks selected for the creation of LCTs were ones that were most commonly found in each sample location in the form of a sizable cobble, flake blank or slab that could be reduced into an LCT. Hammerstones were selected that would make the knapping process most effective and were thus the kind most probably selected by hominids, as no hammerstones were identified from the assemblages at that stage. Consequently, some quartzite hammerstones were selected from the gravels near Swartkrans, with five large cobbles used for primary reduction of the cores and LCTs, and nine small rocks used for further reduction and shaping. The knapped rock and all its pieces were placed into a sample bag, with its sample location, for later analyses.

The knapping process was especially important to help identify features of the various rock types that either hindered or aided the creation of functional tools, and hence these features were isolated as variables that could be quantified. These variables were selected based on the experience NS had from knapping the various rock types and were features that would have been visible to hominids for their selective decisions. All 12 available different rock types were knapped to indicate which ones were easiest to knap. Some flakes of the different rock types were also used to perform various tasks to gauge their effectiveness as a tool. It was determined that tools made from diabase, quartzite, quartz and chert performed the best, as flakes from these rock types were both sharp and durable. These are also the four rock types present in the archaeological assemblages. The experimental samples consisted only of quartz, chert and quartzite as diabase was utilised in very small quantities at these two sites. In addition, the diabase tools had undergone extensive surface weathering since deposition and could thus not be analysed.

*3.3.3 Analytic variables*

The methodology and variables used in this paper were developed by the author during her MSc (Sherwood 2013) and will be described below.

*3.3.3.1 Impurity encounter rate (IER)*

Impurities, flaws and certain structures (referred to as impurities for simplicity hereafter) in rocks hinder a knapper's ability to create stone tools with ease and are thus less desirable than rocks that have none of these present. Various impurities were identified via the experimental knapping and include: joint planes (Figure 3A), bedding planes (Figure 3B), shatter cones (Figure 3C) quartz veins (Figure 3D and E), crystal inclusions (Figure 3F and G), cavities (Figure 3H and I), ooids (Figure 3J and K) and stromatolites (Figure 3L).

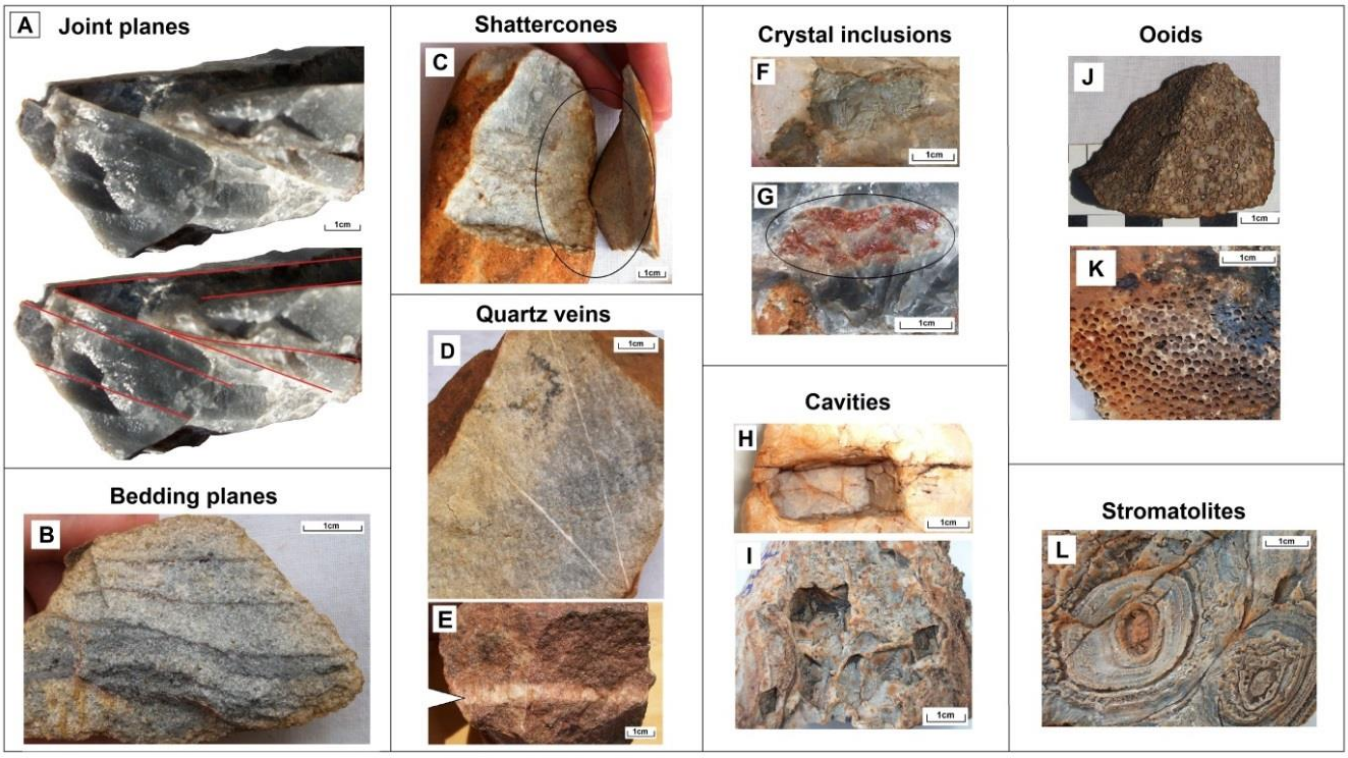


**Fig. 3.** Various impurities that can occur in rock types from the study area (Adapted from Sherwood {2013}).

This paper makes use of the method developed by Brantingham *et al*. (2000) to quantify the frequency of the above-mentioned impurities encountered during primary reduction of an artefact. The impurity encounter rate was calculated by Brantingham *et al.* (2000) by dividing

the number of flake scars encountered on an artefact that exhibited impurities by the total number of flakes scars present. The percentage of impurities encountered was determined by multiplying this by 100 (formula below).

$$impurity\ encounter\ rate\ = \left(\frac{Scars\ with\ impurities}{Total\ no.of\ flake\ scars}\right) \times 100$$

Figure 4A shows examples of how the formula was applied for each lithic. These only show one side of each artefact as an example; however, during the collection of data all the flake scars for each face of an artefact were counted.

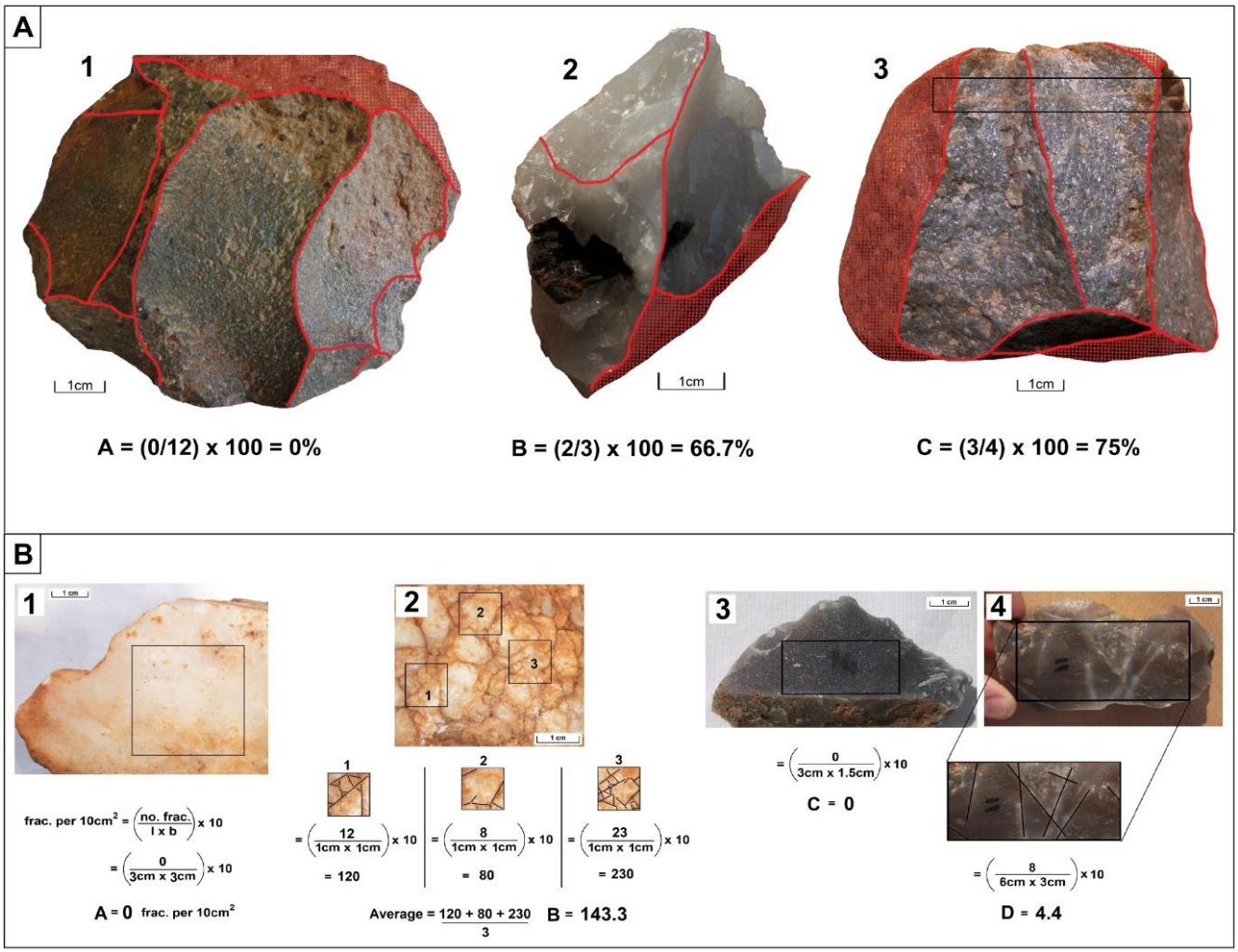


**Fig. 4.** A: Examples of how the IER's were analysed for the various materials, with Formula used as per Brantingham *et al.* (2000). Shaded areas represent where the cortex is located. B: Examples of how the fracture encounter rates were analysed for quartz and chert (Adapted from Sherwood 2013).

*3.3.3.2 Fracture encounter rate (FER)*

Even though joint planes, cavities and crystal inclusions were present in each of the three rock types, fractures (i.e., cracks) were only present in quartz and chert and were thus gauged separately for these two rock types. This was done to see if there was a correlation with joint planes, cavities and crystal inclusions with regards to selection. For artefacts with no visible fractures, a ratio of zero was assigned. For the rest of the artefacts, three flat areas were chosen. This was done on multiple faces of a lithic and not just the cortex. The areas consisted of a length and a breadth, chosen to represent what can be seen on all of the artefact's faces. The number of fractures was counted in each of these areas (Figure 4B). The lengths and the breadths were not always the same sizes due to the varying nature of artefact sizes and shapes. Areas were thus standardised by turning them into a ratio with the formula below.

$$fractures\ per\ 10cm^2 = \left(\frac{no.of\ fractures}{(l \times b)}\right) \times 10$$

To represent the data more clearly each ratio was multiplied by 10 to give fractures per 10 centimetres squared, so the fractions were not too small to deal with. For each artefact the average of all the ratios was taken to represent the fracture encounter rate of that piece. Fractures from the knapping process did occur on some of the more brittle chert pieces that were often lighter in colour due to some weathering and moisture trapped between the silica grains. However, fresh good quality chert did not fracture during knapping, so this was a good way to help quantify chert quality.

*3.3.3.3 Weathering*

Quartz, quartzite and chert are all silica-based, and thus they are reasonably resistant to weathering (particularly chemical weathering) over long time spans (Tricart 1972; Wray 1997; Sleep and Hessler 2006). Nevertheless, silica is slightly soluble in water, with some varieties more so than others (Krauskopf 1956; Siever 1962; Wray 1997). Two main categories of silica are the crystalline type (pure quartz) and an amorphous type (silica cement between grains), and both are found in all three of the rock types in this study. Amorphous silica is more soluble at lower temperatures than the crystalline type (Krauskopf

1956; Siever 1962). Although the three rock types have both kinds of silica present, they have unique structural compositions which facilitate different weathering patterns.

Quartz from the study area is made up of many interlocking macro quartz crystals, which were formed over time in rock formations due to various geological processes, such as pressure from overlying strata. The faces between the interlocking crystals act like planes of weakness (Tallavaara *et al*. 2010) into which water can penetrate and weaken chemical bonds between them. This is done via dissolution and by the precipitation of other minerals. Crystal interfaces have fairly strong bonds between them when unaffected by weathering, but as fluid penetrates, dissolves some of the quartz, and precipitates other minerals, these bonds weaken and crystals push apart (Tallavaara *et al*. 2010). This is visible in the quartz from the cradle as extensively weathered pieces have dark stained cracks clearly visible (Figure 4 bottom right). Flaking predictability is reduced when intersecting such crystal faces and often results in part of the rock shattering into individual crystal chunks when trying to detach flakes during experimental knapping.

Quartzite is a metamorphic rock made up of quartz sand grains in which the sand grains "become cemented and 'welded' together by silica solution that forms during metamorphism" (Cairncross 2004:264). This material weathers between individual grains as fluid penetrates between the grains and dissolves the amorphous silica cement holding the grains together, which eventually leads to the rock breaking down into its original components (Martini 1979; Wray 1997; Doerr 1999; Sleep and Hessler 2006). Dissolution in quartzites starts by fluids entering through joint planes and then proceeding along the boundaries of individual grains (Martini 1979; Wray 1997; Doerr 1999; Sleep and Hessler 2006). These planes are affected similarly to how the boundaries between crystals in quartz are affected. Therefore, quartzites with multiple joint planes will hamper the flaking predictability of a rock, since these boundaries are first to be compromised.

Chert is precipitated rock made up of microscopic silica crystals (cryptocrystalline) (Sleep and Hessler 2006). Chert can consist of either amorphous silica or less soluble microquartz (Siever 1962; Trewin and Fayers 2005). It is more likely that the rocks in our study area are made up of the latter due to the recrystallization (Siever 1962; Trewin and Fayers 2005) of amorphous silica, especially since they are 2.5 billion years old (Eriksson *et al*. 2001). Thus the chert from our study area would consist of microquartz crystals surrounded by amorphous silica cement and would weather similarly to quartzite, but much faster due to its smaller grain size.

Weathering of lithics was quantified by categorising each piece into fresh, intermediate or extensive weathering. This was done for each piece by looking at all the exposed surfaces and not just the cortex. A piece was categorised as fresh if only the cortex was weathered to a maximum depth of 1mm. If an artefact had one side with weathering, but only the fresh side was knapped, it was classified as fresh. Rocks that were weathered to such an extent that they would likely crumble when knapped were classified as extensively weathered. Everything in between was classified as intermediate, as these rocks can successfully produce useful tools. See Figure 5 for visual representations of weathering states.

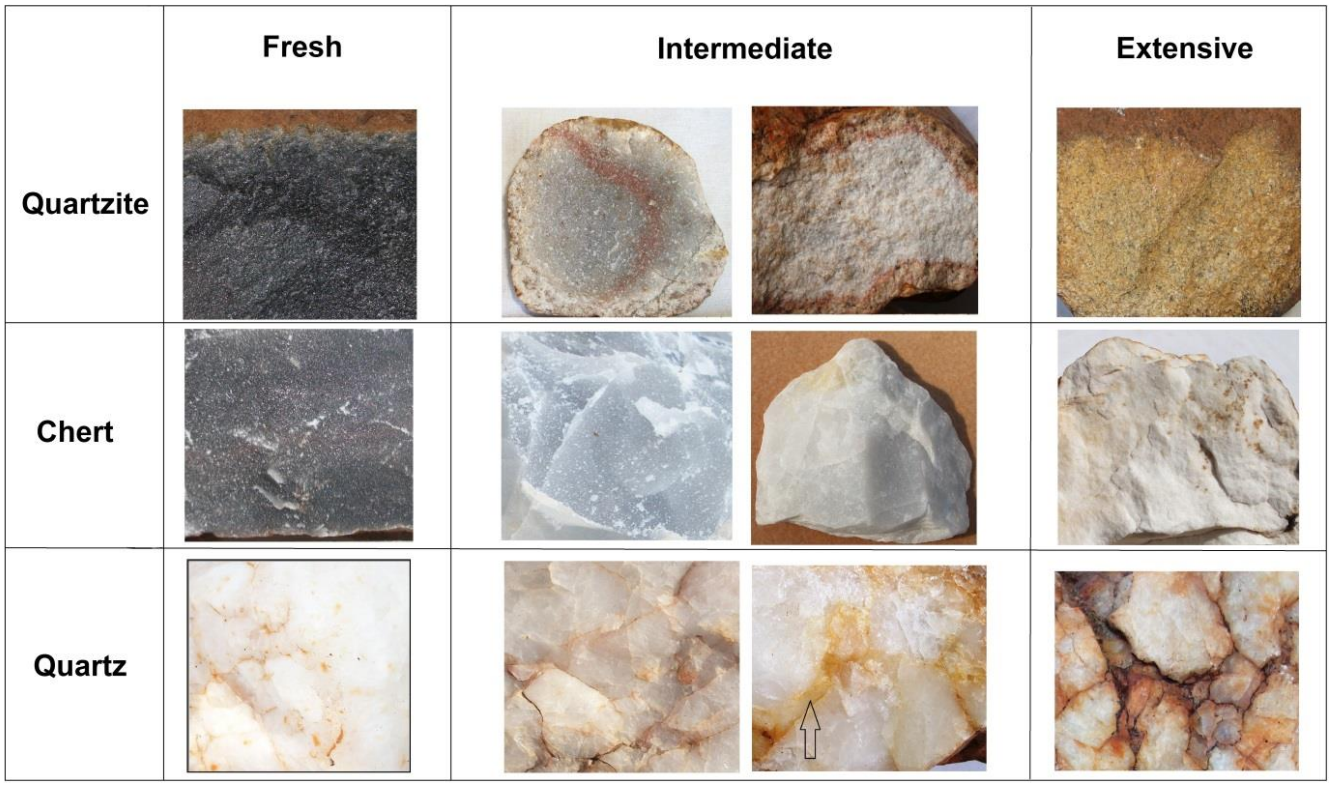


**Fig. 5.** Weathering states of quartzite, chert and quartz (Adapted from Sherwood {2013}).

*3.3.3.4 Grain sizes of quartzite*

This variable was only applied to quartzite because it is the only one of the three materials that exhibits a range of grain sizes between different cobbles. Individual quartzite formations from a certain depositional phase were largely homogenous, but different formations have smaller or larger grains sizes than other formations. Thus, individual cobbles exhibited homogeneity, but cobbles had a variety of size grains between them. The average grain size of an individual lithic was determined using a manual Macroscope M25, which could

measure up to silt sized grains (Figure 6). The grain sizes were categorised in accordance with the Wentworth scale (Wentworth 1922; Table 2). A lithic piece was analysed on various faces and the average grain sizes were recorded visually. For example, in Figure 6A the average grain size is between 0.5 and 1mm which indicates it is composed mostly of coarse-grained sand. In Figure 6B the majority of grains is between 0.1 and 0.25mm, and thus the rock is comprised of fine-grained sand.

**Table 2:** Wentworth Scale

| **Diameter in millimetres** | **Wentworth scale** | |
|---|---|---|
| 256 - 2048mm | Boulders | |
| 64 - 256mm | Cobbles | |
| 4 - 64mm | Pebbles | |
| 2 - 4 mm | Granules | |
| 2 - 1mm | Sand | Very coarse |
| 1 - 0.5mm | | Coarse |
| 0.5 - 0.25mm | | Medium |
| 0.25 - 0.125mm | | Fine |
| 0.125 - 0.0625mm | | Very fine |
| 0.0625 - 0.0039mm | Silt | |
| < 0.0039mm | Clay | |




**Fig. 6.** Grain size visible using the Macroscope M25, the red line is 1mm (Adapted from Sherwood {2013}).

## 3.4 RESULTS

The results are discussed by attribute and compared accordingly between the archaeological and experimental assemblages.

### *3.4.1 Impurity encounter rate*

The average IERs (Figure 7) indicate that both the Sterkfontein and Swartkrans Oldowan and Acheulean assemblages are different from the experimental assemblages. Statistical tests were run on the raw data between the necessary assemblages using the Mann-Whitney test, as the distributions of data sets were not normally distributed. These data sets approximate a normal bell curve, but with heavy tail ends. This is due to many of the lithic pieces exhibiting 0 % or 100 % flawed ratios with everything in between being normally distributed. The box plots in figure 7 show this to some extent. Half of the lithics made from quartzite from the Sterkfontein Oldowan, for example, have a 0 % IER, thus the first two quartiles of this box plot are on the 0 % line. The Mann-Whitney tests indicates a significant difference, above the 95 % level of confidence (Table 3), between the archaeological assemblages and the experimental samples for both the Oldowan and the Acheulean, and for each of the raw material types. This indicates that selection for the quality of lithics types was practiced at both Sterkfontein and Swartkrans during each time period. In addition, the IERs and the accompanying statistics indicate that the Oldowan lithics from Sterkfontein were made of better-quality materials than those in the Swartkrans Oldowan (Figure 7), with a confidence level >95 % using the Mann-Whitney test (Table 3). For the Acheulean, Sterkfontein lithics are overall of better quality (19.0 % vs 26.4 % averages), but this was not statistically confirmed with a p value of 0.087 using the Mann-Whitney test.

For Swartkrans the average IERs indicate that there is an increase in the quality of raw materials used in the Acheulean as compared to the Oldowan, although this is more clearly seen when all the lithics from the various raw materials are analysed together (Figure 8). However, the probability tests (Mann-Whitney) indicate that there is a slight chance (a p value of 0.073) that this could be due to sampling error (Table 3). The Acheulean at Sterkfontein only shows an improvement in quality over the Oldowan for quartz pieces with regards to the average IER (Figure 8). The probability tests indicate that there is little difference between quality selection during the Oldowan and the Acheulean at Sterkfontein (Table 3).

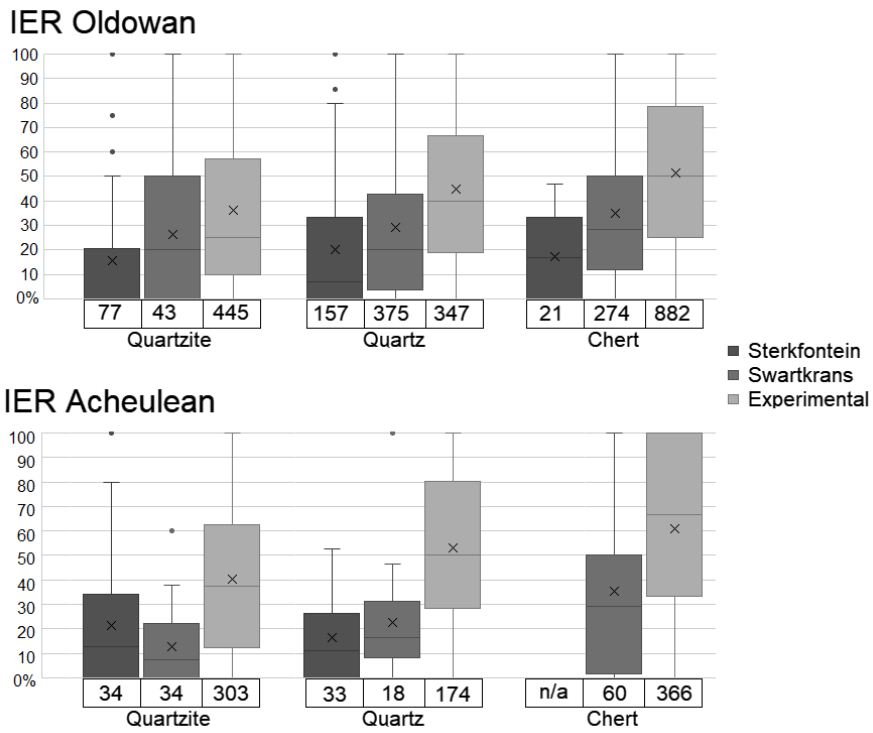


**Fig.7.** Impurity encounter rate (IER) distributions of raw data sets of lithics from the Oldowan, Acheulean and experimental assemblages compared for each raw material from each site. Numbers in squares are sample sizes and X's represent the means of the raw data.

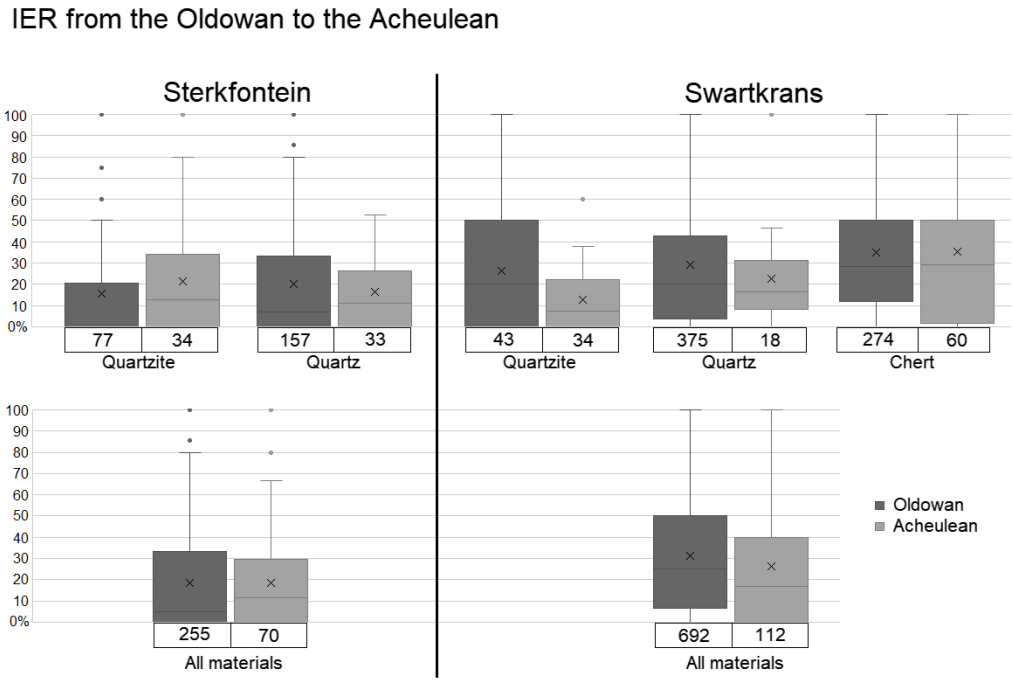


**Fig. 8.** Impurity encounter rate (IER) distributions of raw data sets for each site: Oldowan compared to the Acheulean for each individual raw material and all raw materials combined. Numbers in squares are sample sizes and X's represent the means of the raw data.

**Table 3**: P values from Mann-Whitney test of IERs between the various assemblages.

| **Sterkfontein vs Experimental** | | | |
|---|---|---|---|
| **Oldowan** | | **Acheulean** | |
| Quartzite | < 0.0001 | Quartzite | 0.0012 |
| Quartz | < 0.0001 | Quartz | < 0.0001 |
| Chert | < 0.0001 | | |
| **Swartkrans vs Experimental** | | | |
| **Oldowan** | | **Acheulean** | |
| Quartzite | 0.0550 | Quartzite | < 0.0001 |
| Quartz | < 0.0001 | Quartz | < 0.0001 |
| Chert | < 0.0001 | Chert | < 0.0001 |
| **Sterkfontein vs Swartkrans** | | | |
| **Oldowan** | | **Acheulean** | |
| Quartzite | 0.0077 | Quartzite | 0.330 |
| Quartz | < 0.0001 | Quartz | 0.373 |
| Chert | 0.0115 | | |
| All | < 0.0001 | All | 0.087 |
| **Sterkfontein Oldowan vs Acheulean** | | **Swartkrans Oldowan vs Acheulean** | |
| Quartzite | 0.112 | Quartzite | 0.034 |
| Quartz | 0.858 | Quartz | 0.544 |
| | | Chert | 0.881 |
| All | 0.377 | All | 0.073 |

*3.4.2 Fracture encounter rate*

The occurrence of fractures in quartz and chert from the Oldowan and Acheulean assemblages at both Sterkfontein and Swartkrans is less compared with the experimental samples, with the exception of the Swartkrans chert during the Acheulean, which shows a higher incidence of fractures (Figure 9). Statistical tests done with the Mann-Whitney probability test on the raw data indicate that selection for fewer fractures was present during the Oldowan at both sites (Table 4), but during the Acheulean this was only at Sterkfontein. Similarly, to the IER, both Sterkfontein assemblages have fewer average fractures present as compared to those from Swartkrans (Figure 9 and Table 4).

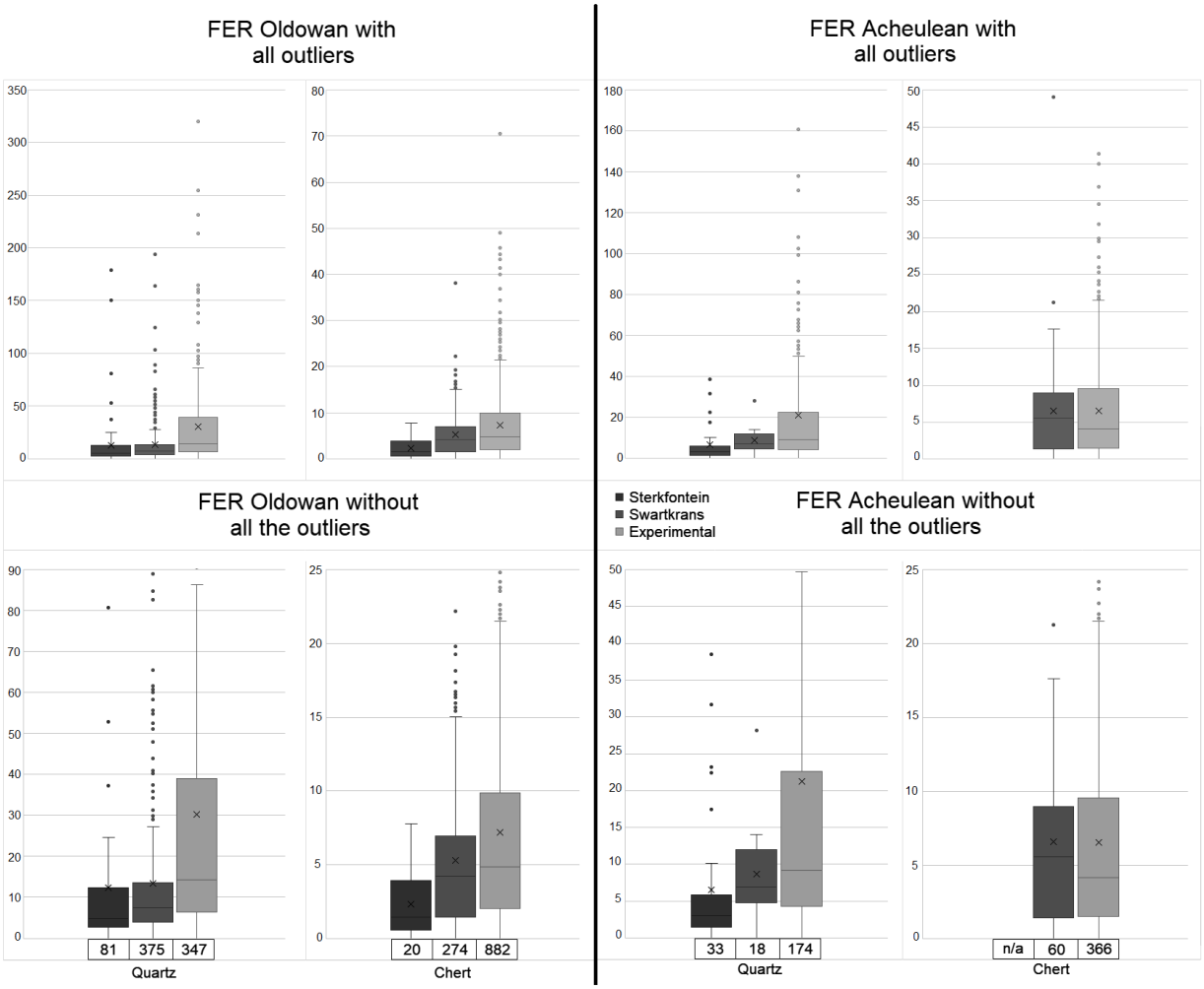


**Fig. 9.** Fracture encounter rate (FER) distributions of raw data sets of lithics from the Oldowan, Acheulean and experimental assemblages compared for quartz and chert. Numbers in squares are sample sizes and X's represent the means of the raw data.

There are fewer fractures present during the Acheulean, compared with the Oldowan, for both sites, which is clearer when all materials are combined (Figure 10). However, there is a chance that this difference might be due to sampling error, as suggested by the statistical tests (Mann-Whitney).

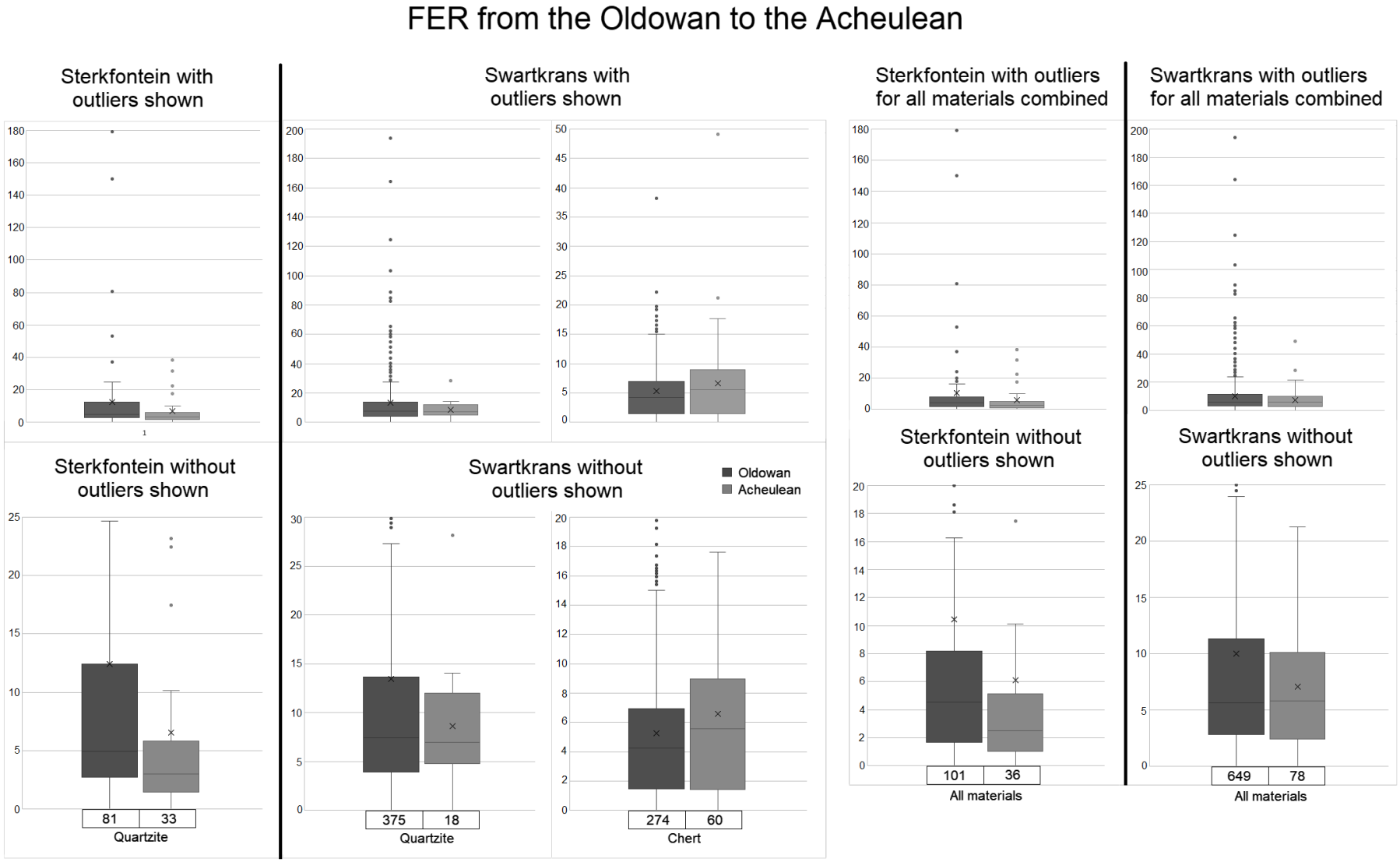


**Fig. 10.** Fracture encounter rate (FER) distributions of raw data sets for each site: Oldowan compared to the Acheulean for quartz and chert material and both combined. Numbers in squares are sample sizes and X's represent the means of the raw data.

**Table 4:** P values from the Mann-Whitney test of FERs between the various assemblages.

| **Sterkfontein vs Experimental** | | | |
|---|---|---|---|
| **Oldowan** | | **Acheulean** | |
| Quartz | < 0.0001 | Quartz | < 0.0001 |
| Chert | 0.0002 | | |
| **Swartkrans vs Experimental** | | | |
| **Oldowan** | | **Acheulean** | |
| Quartz | < 0.0001 | Quartz | 0.320 |
| Chert | 0.0007 | Chert | 0.753 |
| **Sterkfontein vs Swartkrans** | | | |
| **Oldowan** | | **Acheulean** | |
| Quartz | 0.013 | Quartz | 0.006 |
| Chert | 0.007 | Chert | n/a |
| All | 0.039 | All | 0.034 |
| **Sterkfontein Oldowan vs Acheulean** | | **Swartkrans Oldowan vs Acheulean** | |
| Quartz | 0.049 | Quartz | 0.896 |
| Chert | n/a | Chert | 0.208 |
| All | 0.151 | All | 0.496 |

*3.4.3 Weathering*

Both the Oldowan and Acheulean assemblages from Sterkfontein and Swartkrans have less weathered material present than the experimentally created lithics (Figure 11), which were made to represent the average freshness of material that can be sampled from random selection. Chi-square tests between the various samples confirm that the differences are significant (Table 5) despite potential post-depositional weathering that might have occurred on some of the pieces.

Overall the Sterkfontein assemblages consist of fresher material than those of Swartkrans, with the exception of quartzite lithics during the Oldowan (Figure 11). Combining the weathering data for all raw material types indicates that the Sterkfontein assemblages are indeed slightly fresher than those of Swartkrans, which is confirmed by the Chi-square tests (Figure 12 and Table 5). There may be other contributing factors, such as the material at Sterkfontein being deposited at a faster rate.

There is less weathered material during the Acheulean at both sites. The difference is significant at Sterkfontein when all the materials are combined (Table 6). Even though there is fresher material used during the Acheulean at Swartkrans, the overall difference is not significant, but it is significant for quartzite and chert (Table 6). Fresher material during the Acheulean might be due to selection.

**Table 5:** Chi-square tests of weathering states between the various assemblages for each raw material type and combined. STK: Sterkfontein; SWK: Swartkrans; EXP: Experimental.

| **Oldowan** | Quartzite | Quartz | Chert |
|---|---|---|---|
| STK vs EXP | 0.000 | 0.000 | 0.000 |
| SWK vs EXP | 0.000 | 0.000 | 0.000 |
| STK vs SWK | 0.000 | 0.000 | 0.242 |
| SWK vs STK | 0.000 | 0.000 | 0.000 |

| **Acheulean** | Quartzite | Quartz | Chert |
|---|---|---|---|
| STK vs EXP | 0.000 | 0.000 | |
| SWK vs EXP | 0.000 | 0.000 | 0.000 |
| STK vs SWK | 0.000 | 0.000 | |
| SWK vs STK | 0.048 | 0.000 | |

| Combined | **Oldowan** | **Acheulean** |
|---|---|---|
| STK vs SWK | 0.000 | 0.000 |
| SWK vs STK | 0.026 | 0.000 |

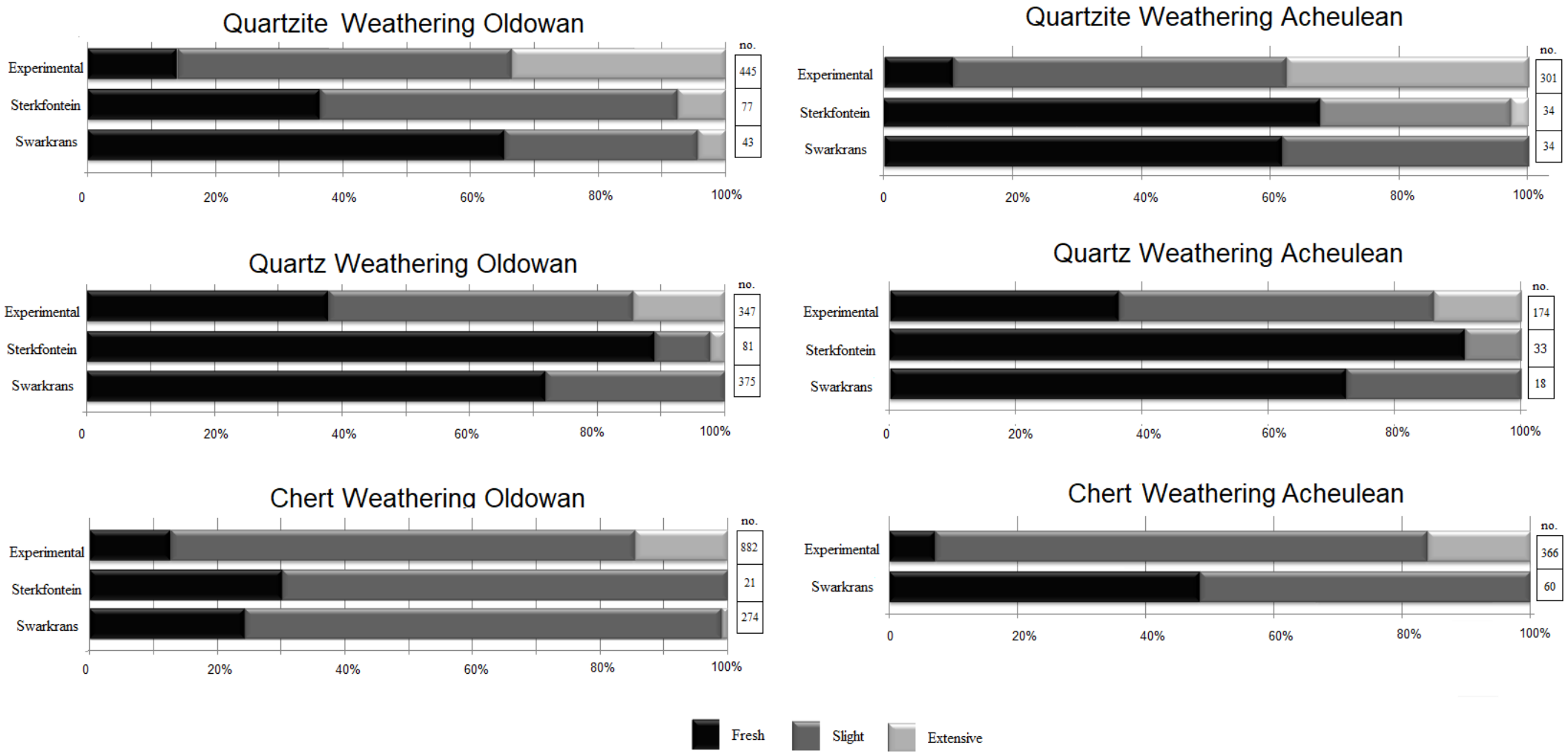


**Fig. 11.** Weathering states of all materials compared to the experimental assemblages, shown as percentages of fresh, slightly weathered and extensively weathered material in each assemblage. Numbers in boxes are sample sizes.

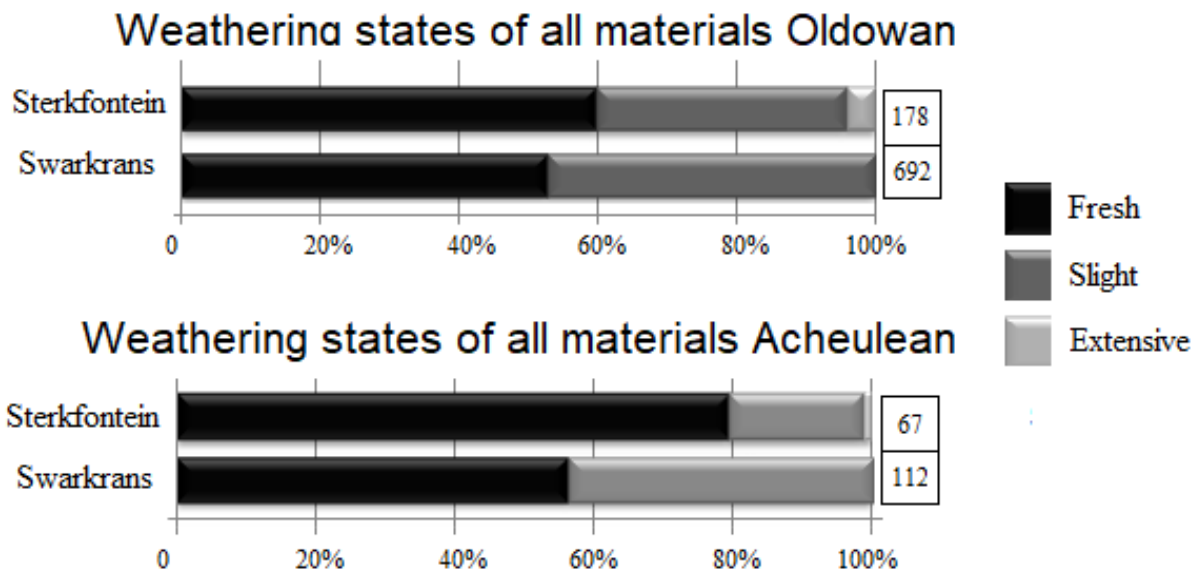


**Fig. 12.** Weathering states of all material combined for Sterkfontein and Swartkrans: shown as percentages of fresh, slightly weathered and extensively weathered material making up each assemblage.

**Table 6:** Chi-square tests of weathering states between the Oldowan and Acheulean assemblages for both sites.

| **Sterkfontein Oldowan vs Acheulean** | |
|---|---|
| Quartzite | 0.000 |
| Quartz | 0.281 |
| All | 0.004 |
| **Swartkrans Oldowan vs Acheulean** | |
| Quartzite | 0.031 |
| Quartz | 0.994 |
| Chert | 0.000 |
| All | 0.549 |

*3.4.4 Grain size of quartzite*

Quartzite lithics in the Sterkfontein and Swartkrans Oldowan and Acheulean assemblages are significantly finer grained than those in the experimental assemblages (Figure 13 and Table7), indicating selection for finer grained quartzites during all time periods. The difference between the Sterkfontein and Swartkrans Oldowan is not significant enough to conclude that more selection for finer grained material was definitely present at Sterkfontein during the Oldowan. This is clear when Swartkrans is compared to Sterkfontein with Sterkfontein as the expected range (Table 7 bold) with a 77 % chance of there being a significant difference. However, the difference between the Sterkfontein and Swartkrans Acheulean is significant, indicating that more selection for finer grained quartzite was likely present at the Sterkfontein site. The tests also indicate that there is an increase in selection for finer quartzites in the Acheulean as compared to the Oldowan at both sites.

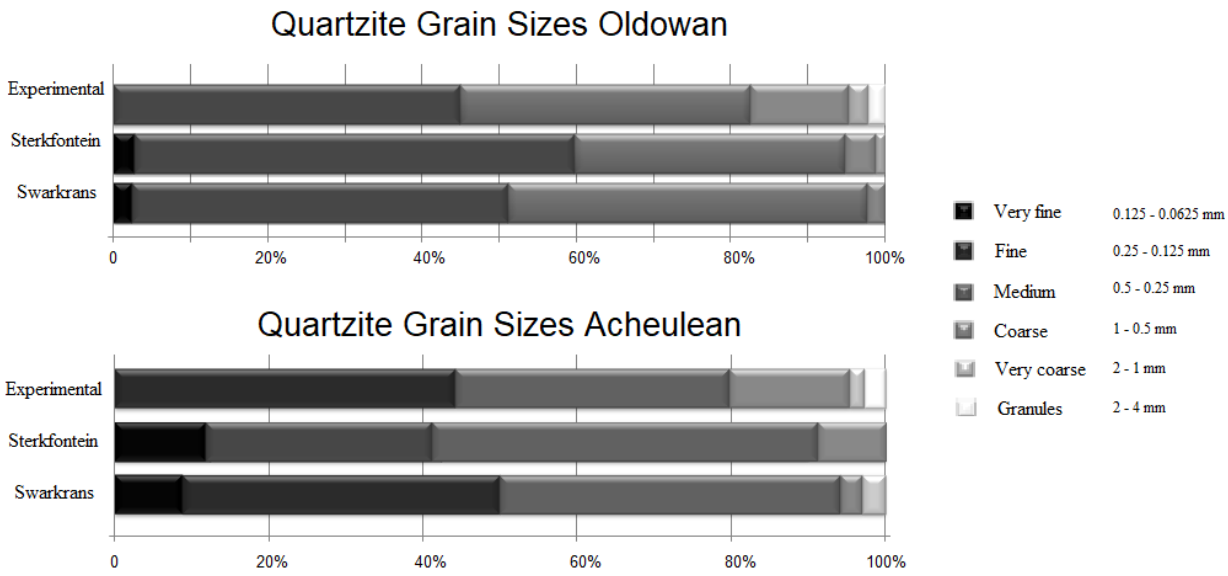


**Fig. 13.** Quartzite grain sizes compared for the various assemblages.

**Table 7:** Chi-square tests of the grain size range of quartzite lithics present in the various assemblages.

| **Oldowan** | | **Acheulean** | |
|---|---|---|---|
| STK vs EXP | 0.000 | STK vs EXP | 0.000 |
| SWK vs EXP | 0.000 | SWK vs EXP | 0.000 |
| STK vs SWK | 0.000 | STK vs SWK | 0.001 |
| SWK vs STK | 0.229 | SWK vs STK | 0.000 |

| **Oldowan vs Acheulean** | |
|---|---|
| Sterkfontein | 0.000 |
| Swartkrans | 0.000 |

## 3.5 DISCUSSION

### *3.5.1 Overall Selection*

The average values for the data, as well as the probability tests conducted on the raw data, indicate that selection of lithic raw material quality from the available rocks on the landscape was indeed present at both Sterkfontein and Swartkrans in the Oldowan and Acheulean assemblages. The summary below demonstrates that hominids selected for multiple facets with regards to rock quality.

- IER: Selection of rocks exhibiting fewer flaws was practiced at both sites during the Oldowan and the Acheulean.
- FER: Selection of less fractured rocks was practiced at both sites during the Oldowan and the Acheulean, except for Swartkrans chert during the Acheulean, which shows a higher occurrence than the experimental assemblage.
- Weathering: Selection for less weathered rocks appears to have been practiced at both sites during the Oldowan and the Acheulean. Despite possible post-depositional weathering of artefacts taking place, the archaeological data still shows significantly fresher weathering states than the experimental assemblage, which represents weathering states when rocks are more randomly selected.
- Grains: Selection of finer grained quartzite was practiced at both sites during the Oldowan and the Acheulean.

As noted above, the average FER of the Swartkrans chert pieces during the Acheulean is slightly higher than the experimental pieces. However, the IER is significantly lower. The rest of the data suggest that there is a direct correlation between selection of the IER and the FER. Clark (1991, 1993) suggests that some pieces from members 2 and 3 could have been broken or fractured from pressure of overburden due to the position of these Members. The majority of chert lithics from the Swartkrans Acheulean is flakes, which are more susceptible to fractures from pressure as they are thinner than cores and chunks. FERs for chert flakes from the Acheulean are almost four times greater than those from the cores, whereas the FERs of flakes from the Oldowan are almost the same as the cores. The FERs from the Acheulean chert flakes are also double that of the Oldowan chert flakes at this site. This is seen to a lesser extent in the quartz pieces analysed; however, there are more quartz cores in relation to flakes, and thus it is not reflected substantially in the data. This could indicate that

there was indeed pressure of overburden on some of the Acheulean pieces, causing post-depositional fractures, particularly for flakes. But, since the IER and FER were analysed separately, we can see that selection for quality of raw materials was still present as the IERs were significantly lower than expected from random selection, despite the occurrence of fractures.

Materials with minimal weathering seemed to have been selected by early hominids when Oldowan and Acheulean assemblages are compared to the experimental samples. The experimental sample shows what the average weathering states of randomly selected rocks would be on the landscape. This might not have been exactly the same for the landscape two million years ago, but it would be a decent approximation, as weathering is a continuous cycle. One issue that needed to be addressed is whether post-depositional weathering had an impact on the results. Figure 14 shows lithic pieces from the Swartkrans Oldowan (A) and the Swartkrans MSA (B). It is clear that there is more surface weathering present on the MSA lithics (approximately 100ka), which accumulated in surface colluvium before it washed into the cave, as compared to the Oldowan lithics (approximately 2Ma) which had spent more of their life history within the cave deposit. Weathering states of lithics from the Oldowan and the Acheulean (which look similar to the Oldowan pieces) seem to have undergone little post depositional weathering, as few pieces exhibit the surface weathering that is seen in the MSA lithics.

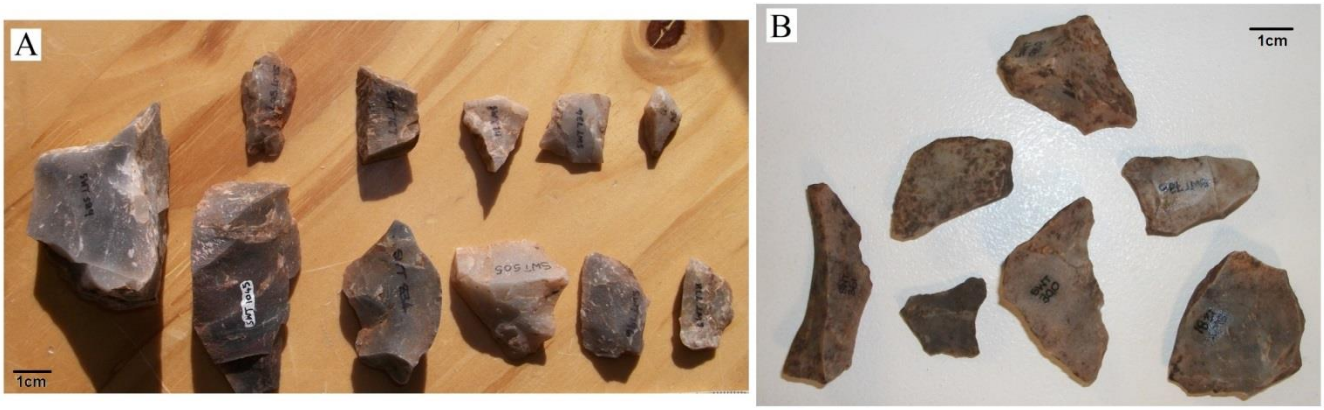


**Fig. 14.** Chert pieces from the Swartkrans Oldowan (A) and Chert pieces from the Swartkrans Middle Stone Age (B).

*3.5.2 Differences between sites*

Overall both the Oldowan and the Acheulean assemblages found at Sterkfontein are of better quality that their Swartkrans counterparts, as summarised below:

- IER: Oldowan and Acheulean lithics from Sterkfontein were made of better-quality materials than those found at Swartkrans.
- FER: The Sterkfontein Oldowan and Acheulean assemblages had slightly fewer fractures present than found in Swartkrans material overall, but this difference might be due to the samples at the sites not necessary representing the full complexity of selection at each site, as the difference is not statistically significant
- Weathering: Overall the Sterkfontein assemblages consist of fresher material than those of Swartkrans, but this might be due to post-depositional factors and not necessarily due to selection.
- Grains: The difference between the Sterkfontein and Swartkrans Oldowan is not significant enough to conclude that greater selection for finer grained material was definitely present at Sterkfontein. The difference between the Acheulean assemblages is, however significant, indicating that more selection for finer grained quartzite was present at the Sterkfontein site.

The differences between the sites could be due to a variety of reasons:

- One site having a more expedient technology.
- One site having closer access to raw materials vs. the other site requiring greater transport of raw materials.
- Personal preferences of different groups of hominids.
- Time differences between the two sites sampling differing behaviours, perhaps even different behaviours of separate species.

Kuman *et al*. (2018) indicate that the Oldowan at Swartkrans was significantly more expedient in nature than the Oldowan technology found at Sterkfontein. In addition, Swartkrans is located very close to the quaternary sediments (river cobbles), whereas Sterkfontein is roughly a half a kilometre away (*ibid*). Raw materials from the river gravels would have been easily accessible at Swartkrans and less distance was be required to transport materials, thus there was probably less interest in selection. However, chert

outcrops are readily available close to each site and would have been easily accessible near Sterkfontein. While quartz exists in the surrounding landscape in the form of the occasional vein, it is more abundant in the river gravels (along with quartzite and chert) (Kuman *et al*. 2018) and of better quality. The majority of each assemblage consists of quartz, which indicates that distance to the main source of raw material may have had a contributing factor to better selection at Sterkfontein. Other unknown conditions around the sites may also have contributed to the selection patterns, such as the presence of more predators in a wetter, more wooded landscape at Swartkrans, leaving less time to select optimal quality rocks.

Selection for quality during the Acheulean at Sterkfontein is slightly better than at Swartkrans; however, this is not as pronounced as during the Oldowan. Also, the sample sizes of artefacts excavated at the sites might not fully represent the entirety of hominid behaviour, as some flakes, cores and formal tools, such as LCTs, might have been transported around the landscape and not made their way into the cave deposits. This is possible for Swartkrans as fewer LCT's were present in the assemblage.

### *3.5.3 Differences through time*

There is an overall improvement in the quality of rocks selected during the Acheulean at both sites. The average IERs and FERs are lower during this time period, although this is not confirmed by the probability tests. Finer grained quartzites were selected at both sites, which probability tests confirm. The weathering states were also significantly fresher during the Acheulean, although we cannot account for the influence of site formation on artefact conditions.

## 3.6 CONCLUSION

In conclusion, selection for better raw material quality was present at both the Sterkfontein and Swartkrans sites for all Oldowan and Acheulean assemblages. From the landscape around the sites and from river gravels, hominids selected raw material types that were best for tool making and exhibited fewer flaws, such as joints, cavities, mass crystal inclusions and fractures. They also seem to have favoured fresher material, as well as finer grained quartzites. The Sterkfontein assemblages are overall of better quality than the ones from Swartkrans, which is possibly due to a larger distance from the main source of raw material.

There is an improvement in quality selection from the Oldowan to the Acheulean, but this is mainly visible in the averages for each variable. It should be noted that the degree of raw material selectivity does not necessarily reflect the degree of cognitive complexity, as other factors, such as knapping skill and habitat location, have an impact on selective decisions and would need to be explored extensively and integrated into such studies.

## CHAPTER FOUR: STUDY TWO

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**Author contributions:** NS designed the method, collected and analysed all of the data, and wrote the paper. LH and LC provided access to the archaeological materials for study in China and to the field where experimental materials were collected and worked by the first author. KK facilitated my research in China and provided helpful suggestions and assisted in editing as my supervisor.

ABSTRACT

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# Lithic raw material quality of Middle Pleistocene artefacts from the Han River, Danjiangkou Reservoir Region, central China

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ABSTRACT

The East Asian Acheulean is often considered distinct from African and European Acheulean technologies as large cutting tools (LCTs) are thicker and heavier on average. This distinction is generally true, but exceptions occur, particularly in thickness, as more Chinese sites are reported. It has been suggested that the raw materials available in East Asia have played a part in determining this dissimilarity. Extensive raw material studies on East Asian technologies have not yet been done to determine if this is indeed the case. It is thus important to investigate the impact of raw materials quality on the East Asian Acheulean. This paper focuses on raw material attributes for LCTs from the Danjiangkou Reservoir Region, central China (DRR), with specific focus on Middle Pleistocene artefacts from Terrace 3 of the Han River. Extensive experimental studies were done to determine raw material attributes and how those attributes affect the knapping process in the creation of LCTs. A set of variables was recorded for the experimental tools and compared with a sample of archaeological LCTs. The variables recorded included: the impurity encounter rates of various raw materials, their weathering states, grain sizes and shapes. The results indicated that hominids occupying the DRR exhibited selective behaviours for the raw materials they used to make LCTs, despite not having a wide variety of materials from which to select. It is also evident that they showed adaptability and made strategic decisions with regards to the selected raw materials for manufacture of LCTs to meet their needs.

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## 1. Introduction

The East Asian Acheulean has not been as extensively researched as the Acheulean in other parts of the world. According to Li et al. (2014), this is largely due to the "Movius Line" model (Movius, 1948, 1969), which argues that East and Southeast Asia in the Palaeolithic was a cultural backwater, as well as the assumption that Chinese LCTs are an indigenous development without influence from Acheulean populations (Gao, 2012). East Asian LCTs are often considered distinct from African and European Acheulean technologies as they are thicker and heavier on average, with greater weight being the most consistent difference (Kuman et al., 2014). It has long been argued that the poorer quality raw materials available in East Asia has played a major part in determining this dissimilarity (Leng and Shannon, 2000; Leng, 2001; Bar Yosef et al., 2012.) Extensive raw material studies on East Asian technologies have, however, not yet been done to determine if this is the case. The purpose of this paper is thus to determine more accurately if and how raw materials have affected the nature of the East Asian Acheulean in the Danjiankou Reservoir Region.

This paper makes use of the term large cutting tools (LCTs) as a general term for handaxes, picks and cleavers, particularly because not all handaxes in the Acheulean are bifaces. In addition, the exact definition of each of these types varies. For example, some Chinese researchers define unifacial convergent tools as picks rather than handaxes (Lin, 1994; Pei et al., 2008; Zhou et al., 2009), whereas the flaking pattern of picks is less important to other researchers than the morphology of the piece. The typological approach to LCTs used in this paper follows Kuman et al. (2014), based on Kleindienst (1962) and Clark and Kleindienst (2001) for the African Acheulean. They define tools such as handaxes, cleavers and picks as "large cutting tools" with the emphasis on the cutting edges or points. This definition is based on morphology and not technique. In our definitions, handaxes have more overall shaping of the body

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of a piece, whereas picks have more focus on a narrow distal end. Cleavers have a wide cutting bit and usually shaping of at least one lateral. Handaxes are further classified into bifacial, partly bifacial and unifacial, in contrast to the popular use of the term 'bifaces' for handaxes, particularly in China (see Kuman et al., 2014 for a detailed discussion). Therefore, to avoid confusion, any tools that could be classified as handaxes, picks and cleavers were classed generically as LCTs in this study, and these included bifacial and unifacial tools.

Another complication in the comparison of LCT traits between eastern and western sites has been the tendency to focus only on western Later Acheulean assemblages instead of considering the variability present throughout this industrial complex. After 600ka, Later Acheulean LCTs in the West are usually more "well-made" when compared to the earlier Acheulean (Roe, 1994; Klein, 2000; Kuman, 2014). Moreover, less refined handaxes also exist in the Later Acheulean and are likely due to a "least effort" approach (e.g., McNabb et al., 2004), exhibiting the variability present even in advanced stages of the technology (Kuman et al., 2014). Despite the overall rarity of more "refined" LCTs in East Asia, some well-made pieces have been discovered, particularly at younger Acheulean sites such as Dingcun and Luonan (Yang et al., 2014, 2016). The LCTs at these sites and in northern parts of China are generally thinner because the tools were made on flake blanks rather than cobbles (Yang et al., 2016). The study by Yang et al. (2016) for Dingcun performed experimental knapping of hornfels, the predominant raw material used at these sites. They confirmed that hard hammer flaking produced the large flake blanks used in this industry, and that soft hammer percussion was not used. Yang et al. (2016) also indicate that LCTs in the south of China from Bose (ca. 0.8 Ma), and at many other East Asian sites, are thicker on average than those found in the northern parts of China because of the greater use of cobble blanks. The LCTs documented in the Danjiangkou Reservoir Region (DRR) in northern central China, however, are thinner, even though many are made directly on cobbles–a phenomenon directly linked to the properties of those cobbles (Kuman et al., 2014).

The importance of experiments to bringing understanding of lithic industries cannot be over-estimated (Flenniken and White, 1985; Toth, 1985; Schick and Toth, 1994; Kuman, 1996; Ludwig and Harris, 1998; Field, 1999; Brantingham et al., 2000; Stout et al., 2005; Braun et al., 2009; Harmand, 2009; Diez-Martín et al., 2011; Goldman-Neuman and Hovers, 2012; Sherwood, N. 2013; Gurtov and Eren, 2014; Byrne et al., 2015; Yang et al., 2016). It is for this reason that extensive experimental knapping was performed to help understand the technology at DRR.

### 1.1. The DRR site complex

This paper analyses LCTs both collected and excavated from Terrace 3 of the Han River in the Danjiangkou Reservoir Region (DRR) by the field team of IVPP (Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences) from the following sites: Datubaozi, Waibiangou and Guochachang (Fig. 1). Approximately 100 Paleolithic sites have been surveyed, of which 30 have *in situ* atrtefacts that have been excavated. The DRR is located on the southern edge of the Qinling mountains, which forms the border between the North and South of China and is fed by the Han River (Li et al., 2014). Sedimentary studies of Terrace 3 place it in the Middle Pleistocene (Yuan et al., 2008; Li et al., 2013), while Electron Spin Resonance (ESR) and palaeomagnetic data

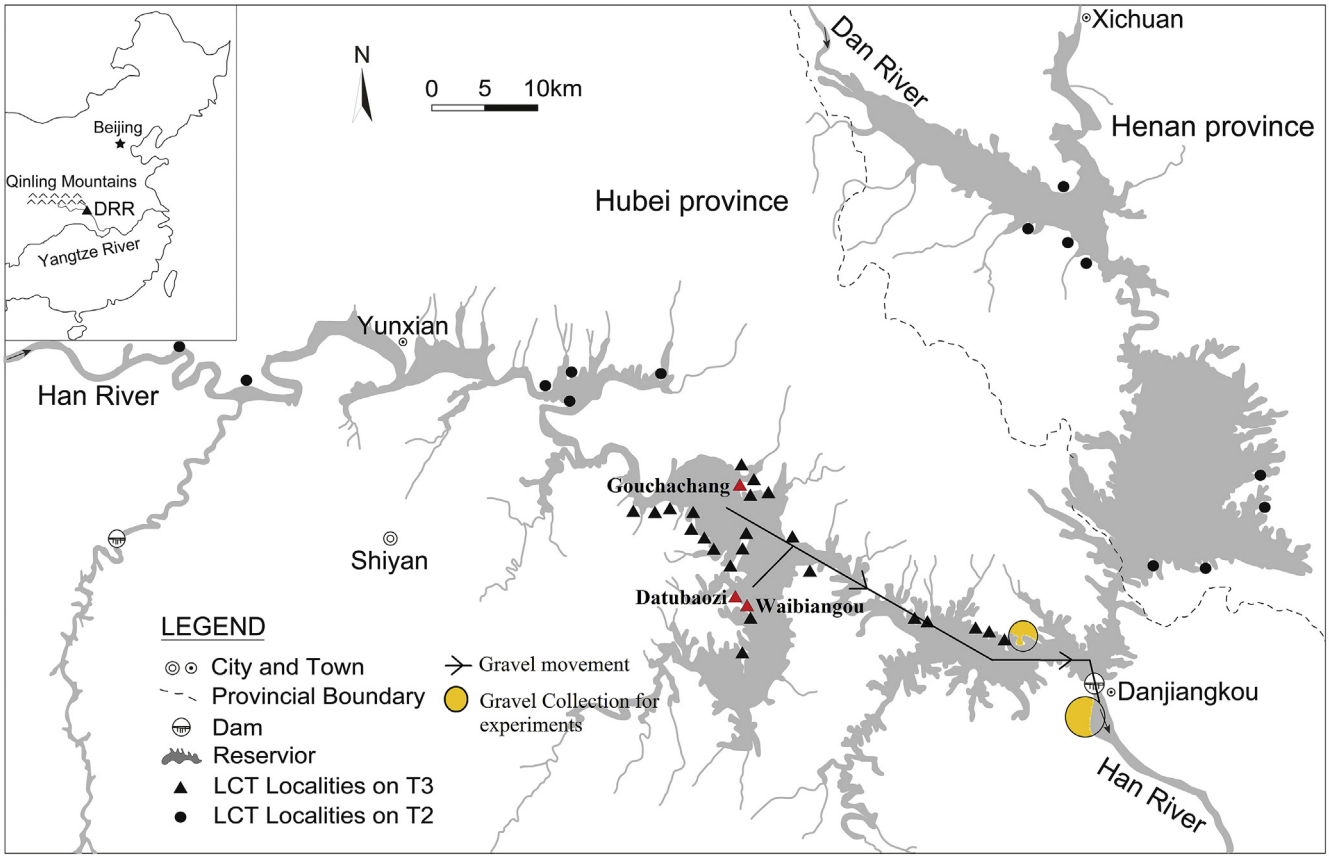


**Fig. 1.** LCT sites in the DRR region, with the three sites used in red. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

indicate that it falls into the early to middle part of the Middle Pleistocene (Li et al., 2014). While bone is not preserved in T3, the older T4 site of Yunxian has produced human fossils (Wu and Dong, 1980; Qiu et al., 1982; Wu and Wu, 1982; Vialet et al., 2010; Li and Etler, 1992), as well as stone tools and faunal remains (de Lumley and Li, 2008; Feng, 2008; Li et al., 2014).

Li et al. (2014) determined that five types of raw materials were used to make DRR LCTs from T3 [quartz phyllite (70.8%), trachyte (20.8%), other igneous rocks (5.6%), quartzite (1.4%), quartz (1.4%)]. DRR LCTs exhibit more secondary flaking scars than primary ones, especially on the distal and middle parts of LCTs (Li et al., 2014), thus showing that more focus was given to refinement of working edges. In the archaeological sample of surface collected LCTs analysed by Kuman et al. (2014), the handaxes made in these materials had a mean length of 172.7 mm (Range 121–226 mm), while other LCTs (mainly picks) showed were somewhat larger in size (see Kuman et al., 2014 for details). For the three excavated assemblages used in this study, the combined LCTs (N = 24) had a mean length of 169.5 mm (range 108–260 mm). The surface collections from those sites (N = 43) had a slightly larger mean of 175.4 (range 117–232 mm). These sizes provided a guide for collection of appropriately sized cobbles for the experiments. The resultant experimental LCTs produced only by Sherwood were similar to the archaeological samples, (N = 35; mean length 166 mm, range 100–245 mm). Because the smallest LCTs were just over 100 mm, experimental cobbles were sleceted from that size upwards.

There is a preference for hominids to select quartz phyllite for LCTs, with 80% of Kuman (2014) sample made from it. This material is the most abundant in the local river banks, but it can often make the knapping process difficult due to its platy structure (Li et al., 2014). According to Pellant (1992), phyllite is a metamorphic rock that belongs to the schist family. It is formed through the metamorphism of rocks such as slates and mudstones and is characterised by a foliated structure due to the preferred orientation of mica within the rock (Farndon, 2006; Marshak, 2013; and see Kuman et al., 2014 pg. 135). Temperature during metamorphism gets high enough to allow mica to recrystallize (Marshak, 2013) and thus creates the foliation (Farndon, 2006). The material from DRR is termed quartz phyllite because it has a high proportion of quartz present (Kuman et al., 2014). The selection of this rock type indicates that the available raw materials did not constrain the making of LCTs in East Asia (Schick, 1994; Lycett and Bae, 2010; Li et al., 2014). The material did, however, influence the morphology and the technology of the tools (Li et al., 2014). Bar Yosef et al. (2012) argue that expert knappers could produce western looking forms on local raw materials in China, such as prepared cores, but the poor quality of the materials imparts its own unique character to an industry, and such is the case for DRR. One such characteristic is the predominance of initial blank types used to make the LCTs. According to a study done by Li et al. (2014), the predominant blank type used was cobbles (47.2%), with large flake blanks (25%) being less frequent. However, a large number of LCTs made on flake blanks consisted of quartz phyllite because LCTs were easier to create thanks to splitting forces that follow the platey stucture of this material. This “is a special adaptation to the local raw material” (Li et al., 2014 p. 168). Quartz phyllite cobbles in the region have a large proportion of flat, amygdaloid shaped pieces, and with well-rounded edges. Since archaeological LCT shapes are usually amygdaloid, elongated and flat, such cobble shapes were selected for flaking because this “can provide a suitable platform and angle for direct invasive flaking of the laterals” and such shapes would be comfortable for holding the tools (Li et al., 2014, p. 68). Thus selecting these cobbles for LCT blanks made sense.

## 2. Methodology and techniques

### 2.1. Experimental knapping

All experiments in this study were performed by Sherwood, and thus knapper variability was not introduced. Rock samples for



**Fig. 2.** Various sampling locations of gravels: Upper left: cobble layer of Han River T3 exposed under the construction of a road. Upper right: clasts dug out from the ancient Han River cobble layer dug out for construction of a building. Lower left: clasts from a quarry sorting factory on the bank of the Han River. Lower right: cobbles distributed on the eroded surface of the Han River terrace three.

experimental knapping were collected from various locations near the city of Danjiangkou from gravels of the Han River (Fig. 2). However, these were of the same geological composition as gravels that are present within the excavated sites, as confirmed by CL and HL, as well as by close inspection of the archaeological material. The Danjiangkou Reservoir Region is located in the southern Qinling tectonic belt, which consists of the intermediate volcanic-sedimentary formations of Precambrian to Mesozoic age. Due to the tectonic movement in the Mesozoic era, northwest-southeast inter-montane fault basins formed deep fault lines in DRR. The Han River flows through the DRR from west to east. It originally formed in the late Tertiary, and the Pleistocene is the primary period for its development. Intermittent neo-tectonic uplift and fluvial erosion caused the development of several river terraces along the Han River in Pleistocene times. In the meantime, alluvial and piedmont sediments deposited on these terraces (Zhu, 1955; Shen, 1956; Chen et al., 1997). The sites were further upstream than the area that cobbles were collected (Fig. 1), which resulted in slightly smaller cobbles downstream on average, however there was still a sizable mix of small and large cobbles (even boulders) to select from.

Cobbles were collected from all the available rock types (Table 1) and extensively knapped to determine their different characteristics and to decide which materials were best for creating LCTs. This was done to compare the rock flaking properties across the materials available to make the LCTs. Hominids preferred quartz phyllite and igneous rock despite quartzite having the least amount of flaws and better flaking predictability, and thus experimental LCTs were primarily made from these two materials for comparison to the archaeological LCTs. The experimental LCTs were made to mimic the typology and technology of the DRR sites as can be seen in Fig. 3. The archaeological LCTs were made by primarily employing the free hand hard hammer technique, thus experimental knapping techniques for the primary shaping process included mostly free-hand hard hammer percussion. However, rod shaped quartz phyllite cobbles were split using the bipolar on an anvil technique, but this technique did not prove to be as effective on quartzite and igneous rock. It required two people to execute, as one person (in this case HL) would hold the elongated cobble on an anvil with its long axis vertical and another person used a hammerstone to strike from above, thus directing forces between the two poles along a cobble's long axis. The passive hammer technique, described in Harmand et al. (2015), where a core is held in both hands and struck against a stationary and fairly large rock, was used on quartzite and igneous rock when initial flake removal proved difficult with the free hand hard hammer technique. The experimental tools were then compared to the artefacts from T3.

### 2.2. Data sets

Several variables were collected from two sets of data: experimental LCTs and archaeological LCTs. The archaeological sample consisted of LCTs from the T3 sites of Datubaozi, Waibiangou and Guochachang. LCTs from these three sites were analysed, including the excavated *in situ* LCTs, as well as surface collections surrounding the sites (See Table 2 for sample sizes). The LCTs from the three sites were treated as one archaeological sample as they were all similar in typology and technology. The experimental sample was created by knapping LCTs from quartz phyllite and igneous rock and to compare the overall quality of the rocks selected for the LCTs in the archaeological material. Cobbles of these materials were selected semi-randomly, thus not selecting for their quality, although the

**Table 1**
Raw material frequencies in the gravels.

| Cobbles >10 cm | Sample A | Percentage | Sample B | Percentage | Total | Percentage |
|---|---|---|---|---|---|---|
| Quartz Phyllite | 33 | 42.9 | 24 | 37.5 | 57 | 40.4 |
| Quartzite | 18 | 23.4 | 19 | 29.7 | 37 | 26.2 |
| Igneous material | 18 | 23.4 | 16 | 25.0 | 34 | 24.1 |
| Quartz | 3 | 3.9 | 3 | 4.7 | 6 | 4.3 |
| Dolomite | 3 | 3.9 | 1 | 1.6 | 4 | 2.8 |
| Chert | 2 | 2.6 | 1 | 1.6 | 3 | 2.1 |
| Total | 77 | | 64 | | 141 | |

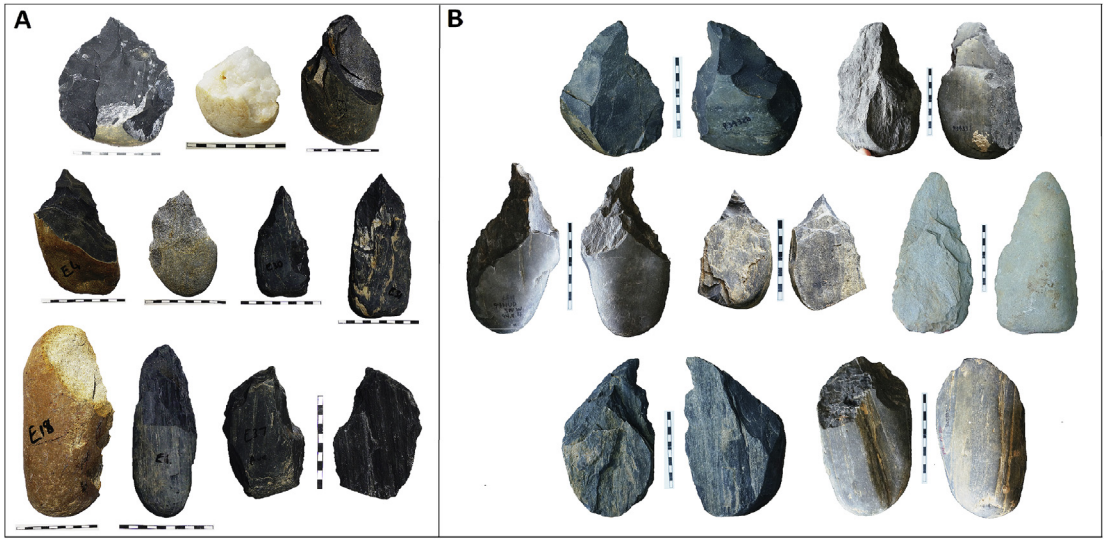


**Fig. 3.** Some of the experimentally knapped stone tools (A) representative of the LCTs found in the Danjiangkou Reservoir Region, central China (B).

**Table 2**
Data sample sizes.

| Artefact sample | No. | Experimental sample | No. |
|---|---|---|---|
| Quartz Phyllite | 15 | Quartz Phyllite | 20 |
| Surface Quartz Phyllite | 35 | | |
| Igneous material | 9 | Igneous | 15 |
| Surface Igneous | 8 | | |
| **Total** | **67** | **Total** | **35** |

size and the shapes of the cobbles were selected with the intent of creating functional LCTs.

### 2.3. Variables

The variables discussed here apply only to experimental and archaeological LCTs made on quartz phyllite and igneous material. The other rock types were also analysed but are presented only in the discussion section of this paper.

#### 2.3.1. Impurity encounter rate (IER)

The presence of macroscopic impurities (flaws) in a rock impedes the knapping process considerably. Flaking becomes unpredictable and often terminates with snap fractures, which become problematic when shaping and thinning LCTs. Impurities that were identified for quartz phyllite via the experimental knapping included: extensive foliation and joint planes (Fig. 4A and B). Cavities were only present in some quartz varieties (Fig. 4C). Joint planes were present in all the different rock types, but not in all specimens. A joint plane is defined as "a single fracture in a rock with or without a small amount (<1 cm) of either dilational or shear displacement" (Hoinkes et al., 2005: 390). In this study a plane refers to any uniform surface of weakness which separates a rock into two pieces, and this includes foliation. Since the archaeological assemblage did not include any LCTs made from quartz, only foliations and joint planes were present in the archaeological specimens.

These flaws were quantified by counting all flake scars that intersect a plane or foliation. The IER was then calculated for each LCT using a similar method to Brantingham et al. (2000) and Sherwood (2013) to quantify the frequency of impurities encountered during primary flaking of an artefact. Brantingham et al. (2000) calculated this rate by dividing the number of flake scars encountered on an artefact exhibiting impurities (ISCAR) by the total number of flakes scars present (DSCAR) and multiplying this by 100 to give a percentage (formula below). Sherwood (2013) provides multiple examples of how the formula is applied.

$$impurity\ encounte\ rate = \left(\frac{Scars\ with\ impurities}{Total\ no.of\ flake\ scars}\right) \times 100$$

#### 2.3.2. Laminae/foliations

Since quartz phyllite is unique in that it is characterised by multiple foliations and was the material most abundantly used to make LCTs, additional variables along with the IER were taken with regards to the lamina. This was done by determining the frequency with which foliations were encountered and the average distance between them.

The frequency was determined by counting the total number of clearly visible laminae on multiple large flattish surfaces of the tool and calculating the average laminae per centimetre. It was done perpendicularly to the lamina, as they are generally parallel to each other (Fig. 5), using a set of dental callipers. Thus the tools with higher numbers of lamina per centimetre will be of worse quality and thus also likely to have smaller average distances between lamina. Tools with no lamina will have a low or zero count and are thus of the best quality.

#### 2.3.3. Weathering

Weathering is important to establish as raw materials become more difficult to knap when extensively weathered. Weathering on tools was determined visually and divided into three categories: fresh, slightly weathered and heavily weathered (Fig. 6).

#### 2.3.4. Igneous rock grain sizes

This variable was applied to igneous material only since the

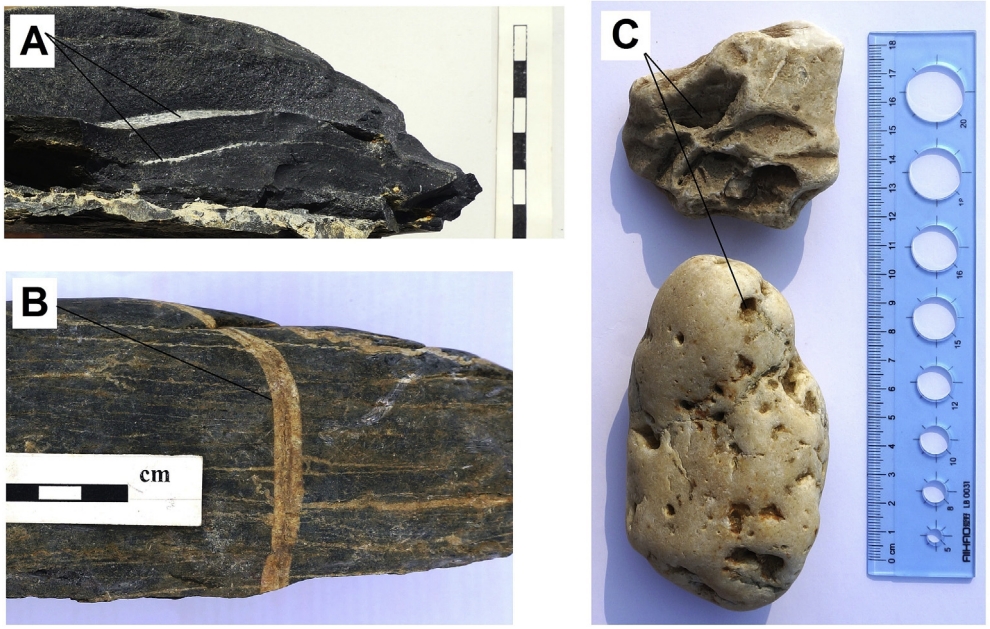


**Fig. 4.** Impurities present in raw materials. A: Foliations; B: Joint plane (foliations also present running perpendicular to plane) and C: Cavities.

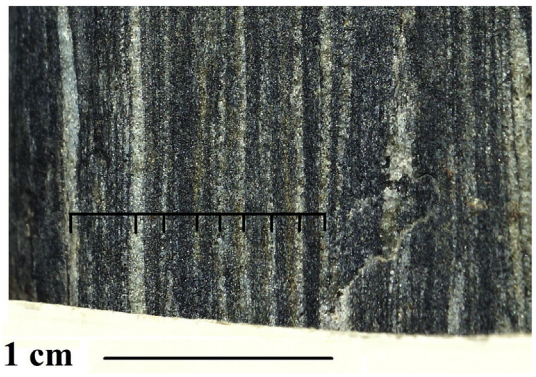


**Fig. 5.** Frequency of laminae per centimetre and average distance between laminae.

quartz phyllite was exceptionally fine grained, but igneous material exhibited some variation (Fig. 7).

The average grain size of an individual artefact was determined by using a Macroscope M25, which could easily measure up to 0.01 mm. The gravels contain at least two different types of igneous material (trachyte and alkali feldspar granite). The majority of these rocks are fine grained, but coarser varieties are available, and these generally have a fine grained matrix with larger crystals embedded in the matrix (phenocrysts), such as in Fig. 7 A. Thus the matrix grain size was recorded for each artefact as well as the average size for the coarser crystals in rocks where they were present.

#### 2.3.5. Shape

The creation of LCTs is made easier by the utilisation of certain initial blank shapes. For example, it is obvious that a large flake blank or an amygdaloid cobble would be easier to turn into a handaxe than a thick cube like block of rock. The LCTs from DRR are perfect for determining the selection of blank shapes as much of the original shape remains. Shapes were quantified by being placed into one of the eight categories by visual reference to the shape types in Fig. 8. To determine if there was selection of certain shapes for the DRR LCTs, their shapes were compared to the frequencies of the different shapes obtainable in the gravels.

## 3. Results

### 3.1. Impurity encounter rate (IER)

For both quartz phyllite and igneous material the IER was higher in the experimental sample than in the artefact sample (Table 3). However the IER for the archaeological LCTs made from quartz phyllite were on average exceptionally high at 62.5%. This indicates that this particular material contains many characteristics that inhibit or restrict the knapping process. Artefacts made from igneous materials exhibited a much lower IER on average, indicating that this is a good material for making LCTs. In addition, no artefacts from terrace three were made from quartzite, which had the lowest IER of all the materials experimentally knapped.

The most abundant material in the gravels is quartz phyllite, followed by quartzite and igneous material (Table 1). However, the artefact assemblage sampled had no quartzite present and consisted mainly of quartz phyllite pieces (75%) and igneous material (25%). Quartzite was occasionally used as is evident from LCTs from terrace one and two, but more quartzite should occur if materials were randomly selected for the creation of LCTs. This indicates that the Middle-Pleistocene people predominantly selected quartz phyllite, as the abundance in the archaeological sample is much greater than its occurrence in the gravels (Table 1).

However, quartz phyllite has the highest IER of all the available material and is thus of the worst quality for knapping. It is obvious that the people selected this material for other reasons, as it makes little sense to purposely select for the most flawed material available. Interestingly though the average IER of the sampled archaeological LCTs is lower than the experimental sample of a random selection of quartz phyllite pieces. A Student's T Test confirms that the two samples are significantly different, with a P value of 0.046. This indicates that the people did select quartz phyllite pieces that were on average less flawed than what was randomly available.

### 3.2. Weathering

The experimental sample indicated that quartz phyllite gravels tend to be rather resistant to weathering with 95% of the sample being fresh (Table 4). This is followed by quartz with 71.4% fresh pieces, then igneous rocks (60%) and quartzite (57.1%). All the artefacts made from quartz phyllite were fresh, even after deposition;

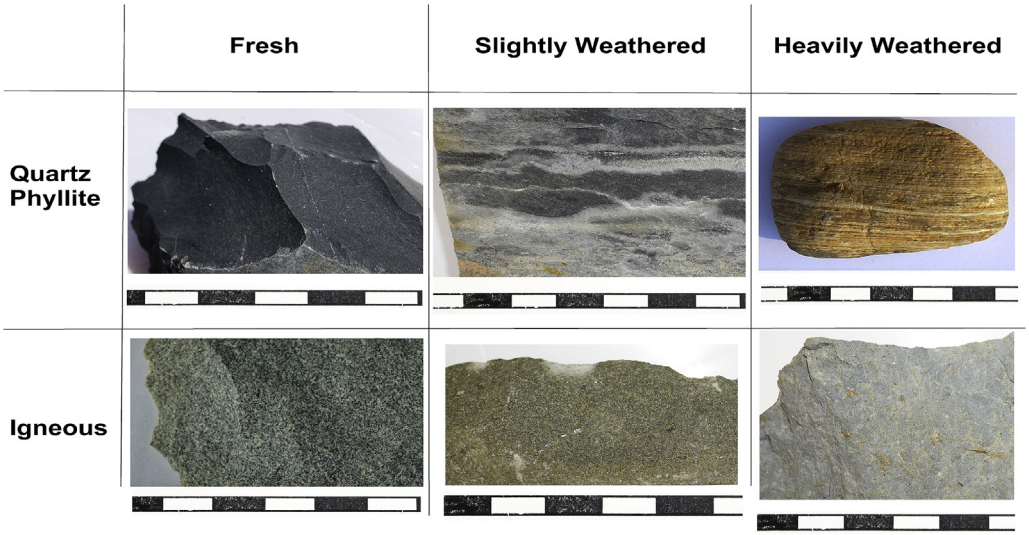


**Fig. 6.** Weathering states of quartz phyllite and igneous material.

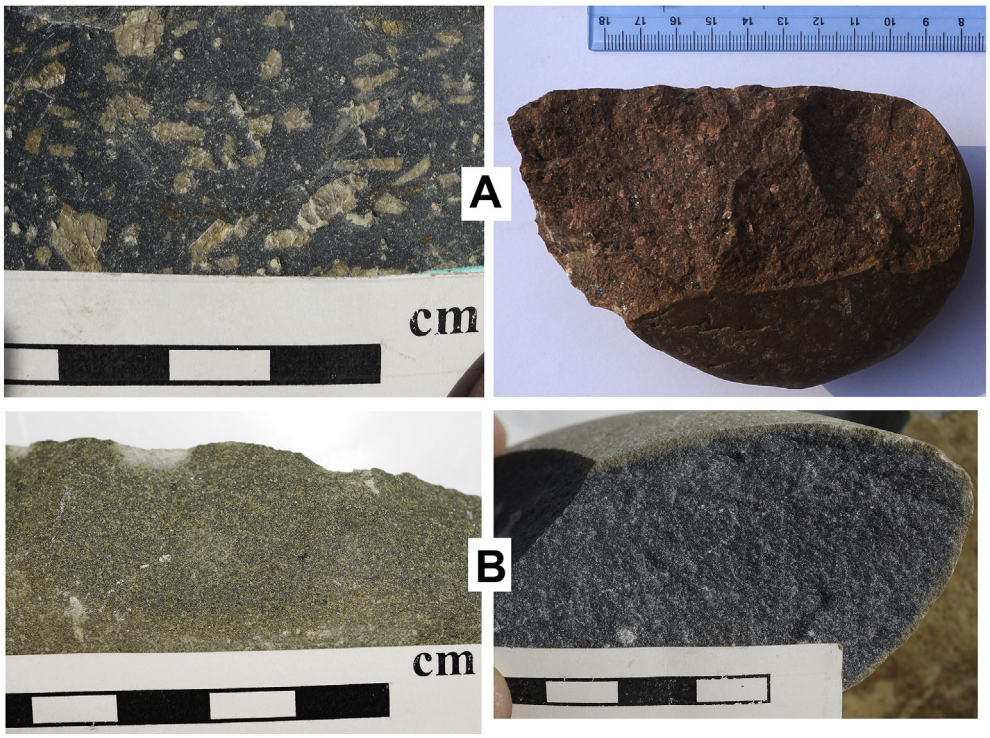


**Fig. 7.** Various grain sizes of igneous material. A: coarse varieties; B: fine-grained varieties.

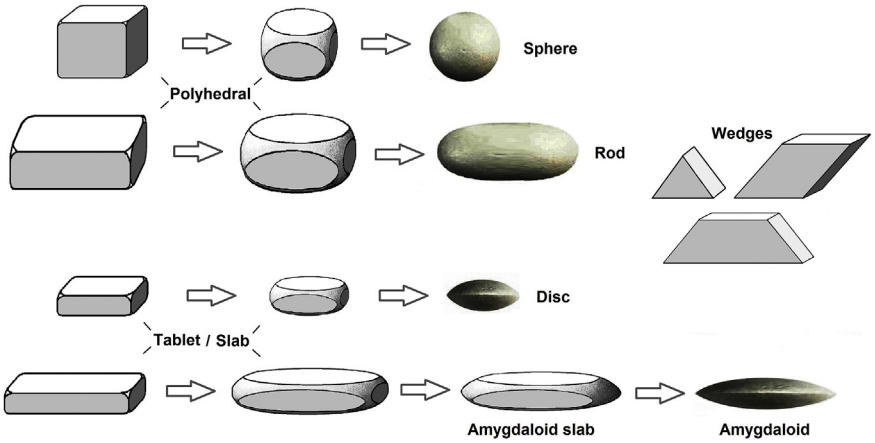


**Fig. 8.** Shape categories for cobbles and artefacts. Polyhedral shapes were generally cube like but could have more than six faces and had angles approaching 90° or greater than 90°. In addition the height of each side would have to be greater than 5 cm, whereas with tablet/slab shapes the height was less than 5 cm. This was determined to be a reasonable height for knapping to attain invasive flakes that could thin the tool.

**Table 3**
Impurity encounter rates of artefacts and experimental tools.

| Artefacts | Sample size | IER | Experimental | Sample size | IER |
|---|---|---|---|---|---|
| Quartz phyllite | 50 | 62.5 | Quartz phyllite | 20 | 74.8 |
| Igneous material | 17 | 13.6 | Igneous | 15 | 26.6 |
| | | | Quartzite | 14 | 16.4 |
| | | | Quartz | 7 | 34.2 |
| | | | Chert | 5 | 65.8 |

however of the 17 LCTs made from igneous material analysed, only 10 could be undoubtedly classified as fresh. The remaining seven had slight weathering on the surface of the tools, but it was not possible to determine if the weathering was already present before knapping or due to post depositional processes. Two of the LCTs in a fresh condition had slight weathering on the surface of the tool but had some of the underlying surface exposed due to modern damage. The interior was exceptionally fresh, with only a thin layer of surface weathering, which was likely post depositional. This could indicate that some of the pieces classified as slightly weathered may have been fresh when knapped.

### 3.3. Laminae

The laminae in the experimental sample were encountered on average more frequently and were closer together (Table 5). The archaeological sample included five tools that had no laminae present or only one on the entire tool. These are exceptionally rare

**Table 4**
Weathering states of the artefacts and experimental LCTs. F: fresh, S: slight, C: Complete.

| Artefacts | Sample size | F | S | C | Experimental | Sample size | F | S | C |
|---|---|---|---|---|---|---|---|---|---|
| Quartz phyllite | 50 | 100 | 0 | 0 | Quartz phyllite | 20 | 95.0 | 5.0 | 0.0 |
| Igneous material | 17 | 58.8 | 41.2 | 0 | Igneous | 15 | 60.0 | 40.0 | 0.0 |
| | | | | | Quartzite | 14 | 57.1 | 42.9 | 0.0 |
| | | | | | Quartz | 7 | 71.4 | 28.6 | 0.0 |
| | | | | | Chert | 5 | 20.0 | 80.0 | 0.0 |

**Table 5**
Number of lamina per centimetre squared and average distance between lamina on artefacts and experimental LCTs.

| | No. Lamina per 1 cm | Average distance between visible lamina, mm |
|---|---|---|
| Artefacts | 2.4 | 10.3 |
| Experimental | 3.2 | 5.3 |

and require extensive searching to locate as only one was sampled for the experimental LCTs and was purposely sought out to represent the best quality of this material in the experimental sample. Student's T Tests indicate a significant difference between the experimental and archaeological samples, with P values of 0.06 for number of lamina per centimetre, and $p = 0.03$ for the average distance between laminae. This further indicates that prehistoric people carefully selected the best quality cobbles of quartz phyllite available.

### 3.4. Grain size

The majority of igneous material available in the gravels was fine grained trachyte. Thus random selection of igneous material would still yield mostly fine grained rocks. This is evident from the experimental sample where the average grain size of the matrix was 0.054 mm (Table 6). The average grain size of the matrix for the archaeological sample was a little lower with 0.047 mm. This was due to two samples being very fine grained (0.025 mm). Only four artefacts had phenocrysts present, with the average size being 3.1 mm. The experimental sample had five specimens with phenocrysts present and an average of 3.2 mm (Table 6). Student's T Tests indicated that there was little statistical difference between the two samples, and thus igneous raw material selection was not primarily based on grain size.

### 3.5. Shape

The majority of artefacts was made on amygdaloidal, rod and tablet shapes (Table 7). However, the shapes most prominent in the gravels were polyhedral or wedge-like (Table 8). Amygdaloidal cobbles made up 16.3% of the sampled gravels, tablets 10.6% and rods only 7.1%. None of the LCTs was made from a polyhedral shape and only one artefact was wedge-shaped and thus 1.5% of the sample. If cobbles were randomly selected, the artefact sample would show many more pieces made from polyhedral and wedge shaped gravels. There was a clear preference for certain shapes. The experimental knapping revealed that amygdaloidal gravels were most efficient for the creation of LCTs, followed closely by disc and tablet forms. Disc shaped cobbles, however, created LCTs that were much shorter and wider than their amygdaloidal counterparts. In addition, rod shapes were best used for quartz phyllite as the cobbles split fairly easily, but this shape proved difficult to split with igneous material. This is reflected to some degree in the results as most LCTs made from quartz phyllite were made from amygdaloidal and rod shapes, whereas LCTs in igneous material were largely made from amygdaloidal shapes.

**Table 6**
Grain sizes of matrix and phenocrysts of igneous material.

| | Matrix grains size mm | Phenocryst grain size mm |
|---|---|---|
| Artefacts | 0.047 | 3.1 |
| Experimental | 0.054 | 3.2 |

**Table 7**
Frequency of blank shapes used to make artefacts.

| Artefact Shape | All | Quartz phyllite | Igneous |
|---|---|---|---|
| Ovoid | 26.9% | 24.0% | 35.3% |
| Rod | 22.4% | 24.0% | 17.6% |
| Tablet | 19.4% | 20.0% | 17.6% |
| Ovoid tablet | 13.4% | 12.0% | 17.6% |
| **Total** | **82.1%** | **80.0%** | **88.1%** |

**Table 8**
Frequencies of cobble shapes naturally found in the gravels.

| Gravels | All material | Quartz phyllite | Igneous |
|---|---|---|---|
| Polyhedral | 20.6% | 33.3% | 5.9% |
| Wedge | 19.1% | 12.3% | 35.3% |
| Ovoid | 16.3% | 15.8% | 14.7% |
| Disc | 14.9% | 5.3% | 23.5% |
| Tablet | 10.6% | 15.8% | 11.8% |
| Rod | 7.1% | 8.8% | 2.9% |

## 4. Discussion and conclusion

Hominids of DRR practiced the selection of two types of rock for LCT production: quartz phyllite and igneous material, with a predominant preference for quartz phyllite. However, this material exhibited the highest impurity encounter rates of all available materials due to its foliated structure. The least flawed material available in the gravels was quartzite, but it was rarely selected because the cobbles took more effort to flake. Despite the selection of quartz phyllite, the IERs of the archaeological artefacts were still lower on average than the quartz phyllite cobbles selected at random, which is evident from the experimental sample. This indicates that hominids did occasionally select for the better quality quartz phyllite. This is confirmed for the archaeological LCTs by the number of laminae per centimetre and the average distance between laminae, which was less and further apart compared with the experimental sample.

The materials most resistant to weathering were quartz phyllite and quartz, followed by igneous material. Knapping experiments

indicated that quartz, however, proved very difficult to knap into LCTs, as large enough cobbles often crumbled unpredictably into smaller pieces, making the shaping process next to impossible. The experiments confirmed that weathered materials did not knap as predictably as their fresh counterparts and did not have very durable edges. This could explain the predominant selection of quartz phyllite and igneous material over quartzite, as many quartzite cobbles were prone to weathering, especially the thinner cobbles with rounded edges, which were the ideal shapes for the creation of LCTs. Both quartzite and igneous materials took more effort to knap than quartz phyllite, especially in the initial shaping process. However, it was easier to acquire thinner cobbles of igneous material that were fresh as opposed to finding quartzite cobbles that were thin and unweathered.

There was a definite selection for specific cobble shapes, with the most common shapes being amygdaloidal, rod, tablet and amygdaloidal tablets, whereas a substantial amount of the available nodules were polyhedral and wedge-shaped. This is to be expected for the creation of LCTs as their shaping and functionality depend on their form. Experimental knapping of the different available shapes in the gravels indicated that the shapes selected by the hominids were in fact the best shapes to achieve the creation of functional LCTs.

There was no statistical evidence to suggest specific selection for grain size when archaeological LCTs in igneous rocks were compared to randomly selected igneous material in the gravels. However, granite varieties were avoided (but they are rare in the gravels) and trachyte was preferred.

It is evident from the results that most selection took place for the raw material type, shape and weathering state of particular materials. Possible reasons are given below:

- The blank shape for the creation of an LCT is exceptionally important, as these shapes form the blueprint for functional LCT forms. The shapes selected were generally elongated and thin (rod being the exception), as visible in the LCTs, and have ideal starting platforms allowing for invasive flaking.
- Rods were selected because they can be easily split (mainly for quartz phyllite) in half along the longitudinal axis, thus creating two blanks that can be turned into LCTs. These halves then have good starting platforms for shaping a working edge and the correct shape for a functional LCT.
- Selection for fresh material was also important as weathered material is more difficult to shape, but also because working edges were less durable and more likely to crumble under heavy duty work. The predominant selection of quartz phyllite thus makes sense, as this was the most resistant to weathering.
- The raw material types selected depended on a combination of different characteristics. Even though the best quality materials, with regard to the amount of impurities present, were quartzite, igneous material and quartz rock, the raw material with the highest amount of impurities was selected more often (quartz phyllite). This was because, despite these impurities, the material had some advantages over the others. As mentioned above, it is more resistant to weathering, which is due to the presence of microscopic quartz crystals. This also makes the material fairly hard and durable, as well as allowing for easy flaking, owing to the nature of quartz fracturing conchoidally. In addition, the nature of the flaws was such that, if the cobbles were knapped strategically, it aided the shaping of LCTs. The foliations being orientated parallel to each other allowed for the splitting of large pieces of this rock and the removal of exceptionally large flakes with less effort and not much percussive force. This was confirmed with the experimental knapping, which proved that knapping and shaping the same size cobbles of quartzite and igneous material needed very large amounts of force to dislodge large and invasive flakes for the initial shaping of the LCT, which likely only the stronger individuals would have been able to accomplish. Furthermore, the experiments also revealed that quartz phyllite could produce edges that are quite sharp and thus exceptional for cutting or getting into places where thick edges would restrict the tool. It was also evident that shaping the finer detail of an edge was rather easy on this material.

The question remains, though, why are the LCTs from this time period not as “refined” as their African counterparts? To answer this question, more refined LCTs were created from the various materials available to see if they would allow for the creation of such tools. It was indeed possible to create more “advanced” LCTs from quartzite, igneous material and quartz phyllite, as can be seen in Fig. 9.

A few likely reasons why tools from DRR are not as extensively shaped are listed below:



**Fig. 9.** Experimentally created refined LCTs.

- Extensively shaped LCTs would have a much larger edge area for use and could have a longer lifespan as a tool. It seems that raw material was abundant and perhaps the hominids of the DRR had no need for tools that required a long use-duration and thus there was no need to expend energy to extensively shape LCTs (Li et al., 2015).
- The LCTs of the region may also have been made for specific or more expedient uses, as the DRR LCTs exhibit more concentration on secondary shaping of a working edge rather than primary shaping of the tool (Li et al., 2014).
- It is important to note that although there is an abundance of gravels available, there are few outcrops of bedrock in the area. This means it would have been difficult to find outcrops where large flake blanks could have been dislodged for making LCTs. Hominids occupying the area were thus restricted to the use of cobbles, which can be shaped into more "refined' tools but are often much thicker and require more effort to extensively shape and refine.

Hominids occupying the DRR certainly exhibited selective behaviours for the raw materials they used to make LCTs. This study revealed that much thought and strategy went into the selection and creation processes to meet their needs. Hominids in the region did not have a wide variety of materials from which to select (such as high quality flint, obsidian and chert), but they adapted to what they had and optimally utilised the materials available to suit their needs.

## Acknowledgements

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## References

Bar Yosef, O., Eren, M.I., Yuan, J., Cohen, D.J., Li, Y., 2012. Were bamboo tools made in prehistoric Southeast Asia? An experimental view from South China. Quat. Int. 269, 9–21.
Brantingham, P.J., Olsen, J.W., Rech, J.A., Krivoshapkin, A.I., 2000. Raw material quality and prepared core technologies in Northeast Asia. J. Archaeol. Sci. 27, 255–271.
Braun, D.R., Plummer, T., Ferraro, J.V., Ditchfield, P., Bishop, L.C., 2009. Raw material quality and Oldowan hominin toolstone preferences: evidence from Kanjera South, Kenya. J. Archaeol. Sci. 36, 1605–1614.
Byrne, F., Proffitt, T., Arroyo, A., de la Torre, I., 2015. A comparative analysis of bipolar and freehand experimental knapping products from Olduvai Gorge, Tanzania. Quat. Int. http://dx.doi.org/10.1016/j.quaint.2015.08.018.
Chen, J., Wu, T., Zhang, P., 1997. Comparative Study of the Multi-division of the Strategraphy of China-Strategraphy in North China. Press of the China University of Geosciences, Wuhan, pp. 135–153 (in Chinese).
Clark, J.D., Kleindienst, M.R., 2001. The stone age cultural sequence: terminilogy, typology and raw material. In: Clark, J.D. (Ed.), Kalambo Falls Prehistoric Site, Volume III, the Earlier Cultures: Middle and Earlier Stone Age. Cambridge University Press, Cambridge, pp. 34–65.
de Lumley, H., Li, T.Y., 2008. Le site de l'Homme de Yunxian. CNRS Éditions, Paris.
Diez-Martín, F., Yustos, P.S., Domínguez-Rodrigo, M., Prendergast, M.E., 2011. An experimental study of bipolar and freehand knapping of Naibor Soit quartz from Olduvia gorge (Tanzania). Am. Antiq. 76 (4), 690–708.
Farndon, J., 2006. The Practical Encyclopaedia of Rocks and Minerals. Lorenz Books, London.
Feng, X.B., 2008. Technological characterisation of China and Europe lower paleolithic industry from 1 Ma to 400,000 years: similarity and difference between the Yunxian hominid culture and European Acheulean. L'anthropologie 112, 423–447.
Field, A.S., 1999. An Analytical and Comparative Study of the Earlier Stone Age Archaeology of the Sterkfontein Valley. M.Sc. Dissertation. University of Witwatersrand, Johannesburg.
Flenniken, J.J., White, J.P., 1985. Australian flaked stone tools: a technological perspective. Rec. Aust. Mus. 36 (3), 131–151.
Gao, X., 2012. Characteristics and significance of Paleolithic handaxes from China. Acta Anthropol. Sin. 31 (2), 97–112 (Chinese, with English Abstract).
Goldman-Neuman, T., Hovers, E., 2012. Raw material selectivity in late pliocene oldowan sites in the Makaamitalu basin, hadar, Ethiopia. J. Hum. Evol. 62 (3), 353–366.
Gurtov, A.N., Eren, M.I., 2014. Lower Paleolithic bipolar reduction and hominin selection of quartz at Olduvai Gorge, Tanzania: what's the connection? Quat. Int. 322–323, 285–291.
Harmand, S., 2009. Variability in raw material selection at the late pliocene sites of Lokalalei, west Turkana, Kenya. In: Hovers, E., Braun, D.R. (Eds.), Interdisciplinary Approaches to the Oldowan. Springer, Dordrecht, Netherlands, pp. 85–98.
Harmand, S., Lewis, J.E., Feibel, G.S., Lepre, C.J., Prat, S., Lenoble, A., Boës, X., Quinn, R.L., Brenet, M., Arroyo, A., Taylor, N., Clément, S., Daver, G., Brugal, J.-P., Leakey, L., Mortlock, R.A., Wright, J.D., Lokorodi, S., Kirwa, C., Kent, D.V., Roche, H., 2015. 3.3-million-year-old stone tools from Lomekwi 3, west Turkana, Kenya. Nature 521, 310–315.
Hoinkes, G., Hauzenberger, C.A., Schmid, R., 2005. Metamorphic rocks: classification, nomenclature and formation. In: Selley, R.C., Cocks, L.R.M., Plimer, I.R. (Eds.), Encyclopedia of Geology. Elsevier Academic Press.
Klein, R.G., 2000. The earlier stone age of southern Africa. South. Afr. Archaeol. Bull. 55, 107–122.
Kleindienst, M.R., 1962. Component of the East African Acheulian assemblage: an analytic approach. In: Mortelmans, G., Nenquin, J. (Eds.), Actes du IV Congrès Panafricain de Préhistoire et de lEtude du Quaternaire, Leopoldville. 1959. Belgie Annalen, Musée Royal de lAfrique Centrale, Tervuren, pp. 81–108.
Kuman, K., 1996. The Oldowan industry from Sterkfontein: raw materials and core forms. In: Pwiti, G., Soper, R. (Eds.), Aspects of African Archaeology: Papers from the 10th Congress of the Panafrican Association for Prehistory and Related Studies. University of Zimbabwe Press, Harare, pp. 139–146.
Kuman, K., 2014. The Acheulean industrial complex. In: Smith, C. (Ed.), Encyclopaedia of Global Archaeology. Springer, New York, pp. 7–18.
Kuman, K., Li, C., Li, H., 2014. Large cutting tools in the Danjiangkou Reservoir region, central China. J. Hum. Evol. 76, 129–153.
Leng, J., 2001. Early Paleolithic Technology in Eastern and Southern Asia. British Archaeological Reports International Series 924. Archaeopress, Oxford.
Leng, J., Shannon, C.L., 2000. Rethinking early paleolithic typologies in China and India. J. East Asian Archaeol. 2, 1–2.
Li, T.Y., Etler, D.A., 1992. New middle Pleistocene hominid crania from Yunxian in China. Nature 357, 404–407.
Li, H., Li, C.R., Kuman, K., 2013. A preliminary report on the excavation of the Guochachang II paleolithic site in the Danjiangkou reservior region, Hubeo province, China. Acta Anthropol. Sin. 32 (2), 144–155 (Chinese, with English Abstract).
Li, H., Li, C., Kuman, K., 2014. Rethinking the "Acheulean" in East Asia: evidence from recent investigations in the Danjiangkou Reservoir region, central China. Quat. Int. 347, 163–175.
Li, H., Kuman, K., Li, C.R., 2015. Quantifying the reduction intensity of handaxes with 3D technology: a case study of handaxes in the Danjiangkou Reservoir Region, central China. PLoS One 10 (9), e0135613.
Lin, S., 1994. Restudy of the nine hand-axe specimens and the applicability of Movius theory. Acta Anthropol. Sin. 13 (3), 189–208 (Chinese with English Abstract).
Ludwig, B.V., Harris, J.W.K., 1998. Towards a technological reassessment of East African Plio-Pleistocene lithic assemblages. In: Petraglia, M., Korisetter, R. (Eds.), Early Human Behavior in the Global Context: the Rise and Diversity of the Lower Paleolithic Period. Routledge, New York, pp. 84–107.
Lycett, S.J., Bae, C.J., 2010. The Movius Line controversy: the state of the debate. World Archaeol. 42 (4), 521–544.
Marshak, S., 2013. Essentials of Geology, fourth ed. W.W. Norton Company, New York.
McNabb, J., Binyon, F., Hazelwood, L., 2004. The large cutting tools from the South African Acheulean and the question of social traditions. Curr. Anthropol. 45 (5), 653–676.
Movius, H.L., 1948. The Lower Palaeolithic cultures of southern and eastern Asia. Trans. Am. Philos. Soc. 38 (4), 329–420.
Movius, H.L., 1969. Lower palaeolithic archaeology in southern Asia and the far East. In: Howells, W.W. (Ed.), Early Man in the Far East. Studies in Physical Anthropology No.1. Humanities Press, New York, pp. 17–82.
Pei, S., Guan, Y., Goa, W., 2008. A preliminary report on the excavation of the pengjiahe paleolithic site in the Danjiangkou Reservoir region. Acta Anthropol. Sin. 27 (2), 95–110 (Chinese with English Abstract).
Pellant, C., 1992. Rocks and Minerals. Dorling Kinderskey, London.
Qiu, Z.L., Xu, C.H., Zhang, W.H., Wang, R.L., Wang, J.Z., Zhao, C.F., 1982. A human fossil tooth and fossil mammals from Nanzhao, Henan. Acta Anthropol. Sin. 1 (2), 109–118 (Chinese, with English Abstract).
Roe, D.A., 1994. A metrical analysis of selected sets of handaxes and cleavers from Olduvia Gorge. In: Leaky, M.D., Roe, D.A. (Eds.), Olduvia Gorge, Volume 5.

Excavations in Beds III, IV and the Masek Beds, 1968-1971. Cambridge University Press, Cambridge, pp. 146–234.
Schick, K.D., 1994. The Movius line reconsidered. In: Corruccini, R.S., Ciochon, R.L. (Eds.), Integrative Paths to the Past: Paleoanthropological Advances, in Honor of F. Clark Howell. Prentice Hall, Englewood Cliffs, pp. 569–596.
Schick, K., Toth, N., 1994. Early Stone Age Technology in Africa: a review and case study into the nature and function of spheroids and subspheroids. In: Coruccini, R., Ciochon, R. (Eds.), Integrative Paths to the Past: Palaeoanthropological Advances in Honor of F. Clark Howell. Prentice-Hall, Englewood Cliffs, pp. 429–449.
Shen, Y.C., 1956. Landscape and its development history of Hanjiang river valley. Acta Geogr. Sin. 22 (4), 295–321 (Chinese, with English abstract).
Sherwood, N., 2013. Lithic Raw Material Procurement through Time at Swartkrans: Earlier to Middle Stone Age. Unpublished M.Sc. Thesis. University of the Witwatersrand, Johannesburg.
Stout, D., Quade, J., Semaw, S., Rogers, M.J., Levin, N.E., 2005. Raw material selectivity of the earliest stone toolmakers at Gona, Afar, Ethiopia. J. Hum. Evol. 48, 365–380.
Toth, N., 1985. The Oldowan reassessed: a close look at early stone artefacts. J. Archaeol. Sci. 12, 101–120.
Vialet, A., Guipert, G., He, Jianing, Feng, Xiaobo, Zune, Lu, Wang, Youping, Li, Tianyuan, de Lumley, M.-A., de Lumley, H., 2010. Homo erectus from the Yunxian and Nankin Chinese sites: anthropological insights using 3D virtual imaging techniques. C.R. Palevol 9, 331–339.
Wu, R.K., Dong, X.R., 1980. Human fossil teeth discovery in Longgudong cave, Meipu, Yunxian, Hubei. Vertebr. PalAsiatica 2, 142–179 (Chinese, with English Abstract).
Wu, R.K., Wu, X.Z., 1982. Human fossil teeth collected from Xichuan, Henan. Vertebr. PalAsiatica 20 (1), 1–9 (Chinese, with English Abstract).
Yang, S.X., Huang, W.W., Hou, Y.M., Yuan, B.Y., 2014. Is the Dingcun lithic assemblage a “chopper chopping tool industry or Late Acheulean”? Quat. Int. 321, 3–11.
Yang, S.X., Hou, Y.M., Pelegrin, J., 2016. A late Acheulean Culture on the Chinese Loess plateau: the techno-economic behaviour of the Dingcun lithic industry. Quat. Int. 400, 73–85.
Yuan, B., Xia, Z., Li, B., Qiao, Y., Gu, Z., Zhang, J., Xu, B., Huang, W., Zeng, R., 2008. Chronostratigraphy and stratigraphic division of red soil in Southern China. Quat. Sci. 28 (1), 1–12 (Chinese, with English Abstract).
Zhou, Z., Wang, C., Goa, X., 2009. A preliminary report on the excavation of the Beitaishanmiao Paleolithic site at Danjiangkou Reservoir Region, south China. Acta Anthropol. Sin. 28 (3), 246–261 (Chinese with English Abstract).
Zhu, Z.D., 1955. Valley landscape of Hanjiang river upstream between Danjiangkou to Baihe. Acta Geogr. Sin. 21 (3), 259–270 (Chinese, with English abstract).

## CHAPTER FIVE: STUDY THREE

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ABSTRACT

1. Introduction
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REFERENCES

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# Experimental flaking in the Danjiangkou Reservoir Region (central China): A rare case of bipolar blanks in the Acheulean

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ABSTRACT

The exploration of techniques used to produce large flakes has long been a focus in Acheulean studies, especially from an experimental perspective. In this study we develop an experimental methodology to analyze Acheulean materials from the Danjiangkou Reservoir Region (DRR) in central China. The results show that large flakes experimentally produced with the bipolar technique can be easily distinguished from flakes produced by the other techniques due to the compression fracture unique to this method of flaking. These bipolar flakes show features consistent with those observed on a portion of the DRR archaeological handaxes. We suggest that the internal flaws and foliated structure found in quartz phyllite can actually assist in splitting cobbles, and consequently, they make bipolar flaking easier and effective. The anvil and throwing techniques have the next most successful ratio in detaching large flakes. The freehand technique is the least successful. Overall, the experimental study reported in this paper clearly demonstrates that raw materials influence the choice of flaking techniques, and the bipolar technique is a unique characteristic of the DRR Acheulean.

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## 1. Introduction

The ability to detach large flakes (maximal size generally ≥10 cm) is widely accepted as distinguishing the Acheulean technocomplex from the earlier Oldowan technocomplex (e.g., Isaac, 1969; Semaw et al., 2009; Beyene et al., 2013). As a result, the exploration of technologies used to produce large flakes has long been a focus in Acheulean studies, especially from an experimental perspective, which can provide direct evidence to reconstruct the flaking strategies (Jansen, 1926; Goodwin, 1929, 1934; Corvinus, 1983; Schick and Toth, 1993; Texier and Roche, 1995; Toth, 2001; Madsen and Goren-Inbar, 2004; Sharon, 2007; Shipton et al., 2009; Mourre and Colonge, 2009–10).

Early experimental studies mainly focused on the physical actions involved in the techniques used to produce large flakes (see Inizan et al., 1999 [p.30]). The Chinese Palaeolithic specialist Pei Wenzhong (also known as W.C. Pei among western scholars) was a pioneer in this work. He systematically undertook experiments by using three techniques, namely, freehand, bipolar and anvil (also known as the block-on-block technique, or the anvil-chipping technique; Pei, 1936). After comparing experimental flakes produced with each technique, he summarized three characteristics for anvil products—namely, large platform size and angles (interior angles from 90° up to 170°), large bulbar scars, and strong force waves on the ventral face; and further argued that these features can be used to distinguish flakes produced by freehand versus anvil techniques (Pei, 1936; Pei and Jia, 1958). Based on Pei's work, Breuil and Lantier (1965) redefined the anvil technique and confirmed the results achieved by Pei. Importantly, they claimed that the anvil technique is more suitable and effective than freehand percussion for producing large sized flakes. They further thought that this technique was widely used in the European Clactonian and Abbevillian cultures, due to the large flake tools found at these two sites.

However, different opinions have arisen since François Bordes' (1968) replication experiments using anvil and freehand techniques. He concluded that the same features can be produced by either technique. Bordes' experimental study has been influential, and debate is ongoing on how to distinguish large flakes produced by different techniques accurately, or if it is even possible to do so (Wang, 1989; Schick and Toth, 1993; Shen and Wang, 2000; Clark and Kleindienst, 2001; Wang, 2004; Yang et al., 2016). Regardless of opinions held, we demonstrate that experimental study is a method essential to understanding the technological choices of Acheulean hominids.

Another aspect of experimental studies that attracts great interest is the concept of technological organization for the working of cores prior to the detachment of large flakes (i.e., the knapping methods as defined by Inizan et al., 1999). Currently, various flaking strategies are identified, with the term "Acheulean giant core technology" adopted to encompass all known strategies (Sharon, 2007). A well-known example is the

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experimental study of reduction methods in Gesher Benot Ya'aqov (GBY). The bifacial core method and the sliced slab method were identified through experimental reconstructions of core reduction, and clearly, different methods are flexible adaptations to the specific qualities and shapes of available raw materials in this region (Madsen and Goren-Inbar, 2004; Sharon, 2007). This example demonstrates well that experimental study is a key means for reconstructing the reduction strategies of giant cores in the Acheulean.

### *1.1. Large flake production in the Danjiangkou Reservoir Region (DRR)*

Danjiangkou Reservoir Region (DRR) is a handaxe-bearing region in central China and is currently studied by the authors (Kuman et al., 2014; Li et al., 2014a, 2014b, 2014c). Handaxes are buried in the fine clay deposits of the third terraces of the Han River, which flows through and feeds the DRR (Fig. 1). Palaeomagnetic and ESR dating have placed the third terrace deposits to the earlier half of the Middle Pleistocene (Li et al., 2014c). To date, 105 handaxes are both surface-collected and excavated from 22 sites in DRR. Fig. 1 shows all the palaeolithic sites (with and without handaxes) currently discovered in DRR. According to Sharon's (2007) definition, the raw materials used in DRR were giant (>30 cm) to medium (from 10 to 30 cm) sized clasts collected from the nearby gravel layers of the Han River (Fig. 2). Random sampling to determine the proportions of different raw materials in DRR shows that 39.1% (N = 34/87) is quartz phyllite (see Fig. 2:b). In our archaeological samples, quartz phyllite is the predominant raw material used for DRR handaxes, with a proportion of 73.3% (N = 77/105). It is a metamorphic rock that belongs to the schist family. Thus, the foliated structure is very developed in most of these rocks (see Kuman et al., 2014 for a detailed description of this raw material).

In a detailed study of handaxes retrieved from recent investigations in this region, Li et al. (2014b) show that large flake blanks, which comprised 47.6% of the handaxe collection, were systematically used to make handaxes, along with cobbles and split cobbles as the other types of blank. Our analysis also shows that most of the handaxes were actually made on primary flakes, or cobble opening flakes. Specifically, nine out of 10 of those for which the striking platform can be identified have a cortical platform, and only one has a plain platform. The preservation of cortex on the dorsal face averages 23%, with some examples having up to 80% (Li et al., 2014b). This evidence shows that the cobble opening method was the main strategy chosen in the DRR for detaching large flakes. Fig. 3 presents archaeological examples of cobble opening flakes and handaxes made on these blanks. As commented by Sharon (2007), the cobble opening method for producing large flakes is less complicated than other well organized technologies. However, this does not mean it is not sophisticated; attention was paid to raw material size and shape, and to the systematic removal of a single, pre-planned primary flake (Sharon, 2007). Elsewhere, we also concluded that this method required an intentional selection of the original shape and size of the clasts to be used (Li et al., 2014b). Because the cobble opening method was used in producing large flakes, our research in this paper focuses on which physical actions or flaking techniques were used to detach large flakes from cobbles in the initial stage of reduction, and on the efficiency of different techniques in a comparative context.

We have also observed that large bipolar flakes were notably used as blanks to make handaxes in the DRR (Kuman et al., 2014; Li et al., 2014a, 2014b, 2014c). Among the 77 handaxes made of quartz phyllite, 46.8% (N = 36) were made on flakes, including 15.6% (N = 12) that were clearly made on bipolar flakes (see Supplemental Online Material [SOM] Table S1 for raw data). Although the proportion of the bipolar flakes is not high, this is a significant component in the DRR large flake production system. Large bipolar flakes are seldom reported from other Acheulean regions as blanks for handaxes. Therefore, if this conclusion can be further confirmed from an experimental perspective, it will contribute to our understanding of the technological flexibility and diversity during the Acheulean stage.

The experimental flaking in this study is goal-directed. We set out to address two questions: 1) to confirm the existence of bipolar technique in DRR large flake production; and 2) to compare the efficiency of four flaking techniques (freehand, bipolar, anvil and throwing) for quartz phyllite and determine which techniques were probably more frequently used by hominids. Both questions are closely related to the understanding of how the DRR hominids adapted their technology to the local raw materials.

## 2. Materials and methods

Both experimental and archaeological materials (see references above) were used in this study. For experimental materials, 80 flake production experiments were conducted (see SOM Table S2 for raw data). The experimental protocol included the initial stage of raw material procurement, with cobbles mainly collected in the region. Fig. 2 shows gravels that we accessed, which were exposed during the construction of roads, bridges or other facilities. Because of the predominance (73.3%) of quartz phyllite handaxes in the DRR, we focused on investigating the influence of quartz phyllite on the flaking techniques used in the replications. In selecting raw materials, flat and oval gravels were preferred, while those with a spheroidal shape were used less due to the lack of suitable angles for striking platforms. Both giant and

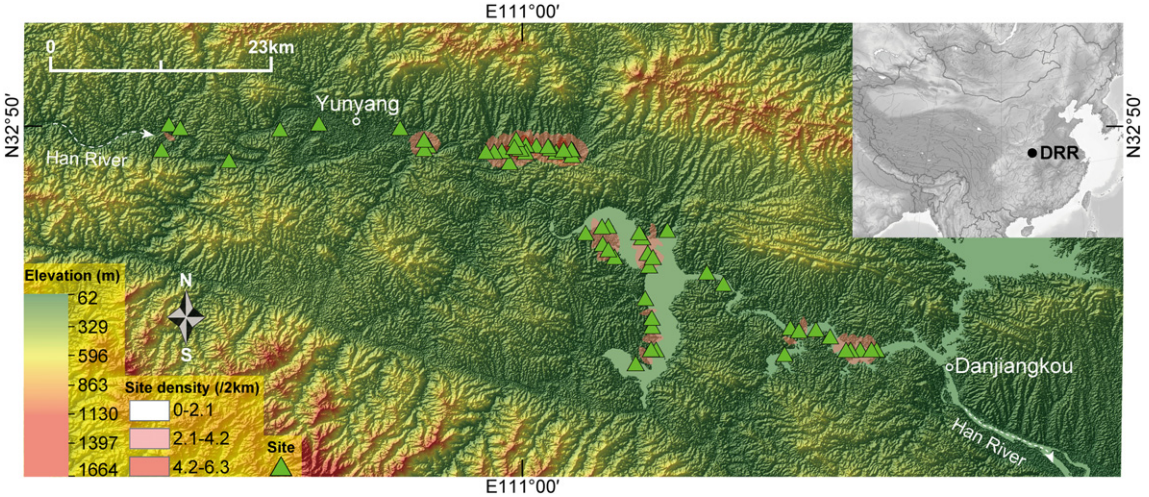


**Fig. 1.** Location of the Danjiangkou Reservoir Region (DRR) and distribution of the Palaeolithic sites in this area.

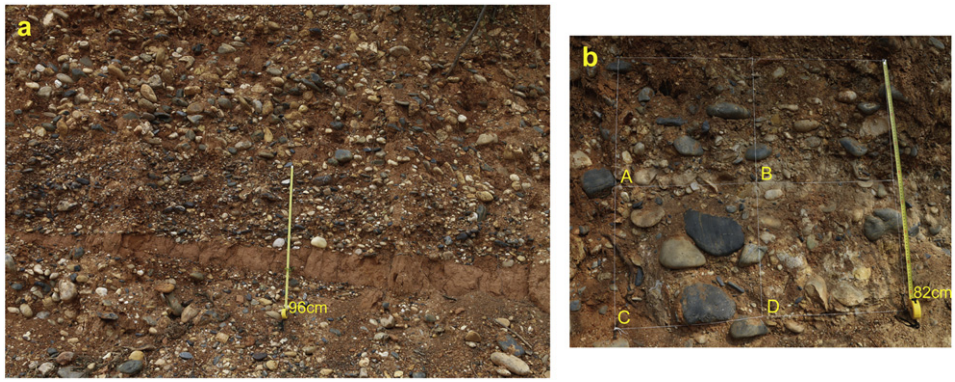


**Fig. 2.** Raw materials exposed in gravel layers along the Han River. "a" shows an exposed gravel layer in profile; "b" shows how the proportions of raw materials were calculated in this study. The proportion of quartz phyllite in quarter-square "A" is 46.7% (N = 14/30), quarter-square "B" is 36.4% (N = 8/22), quarter-square "C" is 20% (N = 4/20), quarter-square "D" is 53.3% (N = 8/15). The total proportion of quartz phyllite is 39.1% (N = 34/87).

medium sized clasts were collected. Prior experience guided us in selecting the most appropriate raw material sizes for each technique. For example, larger clasts were used for the anvil technique than for bipolar, with size differences being statistically significant ($p < 0.001$; see Table 1 and SOM Table S2). The most appropriate stone hammers and anvils were also selected according to technique (see Fig. 4 for examples).

Three knappers, H.L, C.L and N.S engaged in the experiments, all of whom have good experience in knapping and in the study of Acheulean materials and have a deep understanding of the different techniques used in our replications. To avoid individual variation, however, H.L was the main knapper who has conducted more than half of experiments for each flaking technique. Knappers corresponding to each group of experimental products are documented in SOM Table S1. Four techniques, namely, the bipolar, freehand, anvil and throwing techniques, were employed to detach cobble opening flakes in an initial stage of the reduction process. Twenty experimental flake production attempts were conducted with each of the four techniques (see SOM Table S2 for raw data), and each sample was struck until a flake detached, regardless of whether it was useful or not. Such a design fits the nature of cobble opening flake blanks observed on the archaeological samples (Li et al., 2014b). Occasionally repeated flaking failed to produce a flake or other product and was classed as failed along with the unusable products. Fig. 5 shows the knapping motion for each technique. For the bipolar technique, two persons were involved in the knapping process. One person holds the core on a stable anvil, while the other uses a large hammer to strike the core longitudinally from the top. Freehand percussion consists of putting a core on one leg and holding it firmly with one hand, while striking the core with a hammer held in the other hand. The other two techniques, anvil and throwing, are distinguished as follows. In the anvil technique the core is held continuously in the hands and struck repeatedly against a stationary anvil

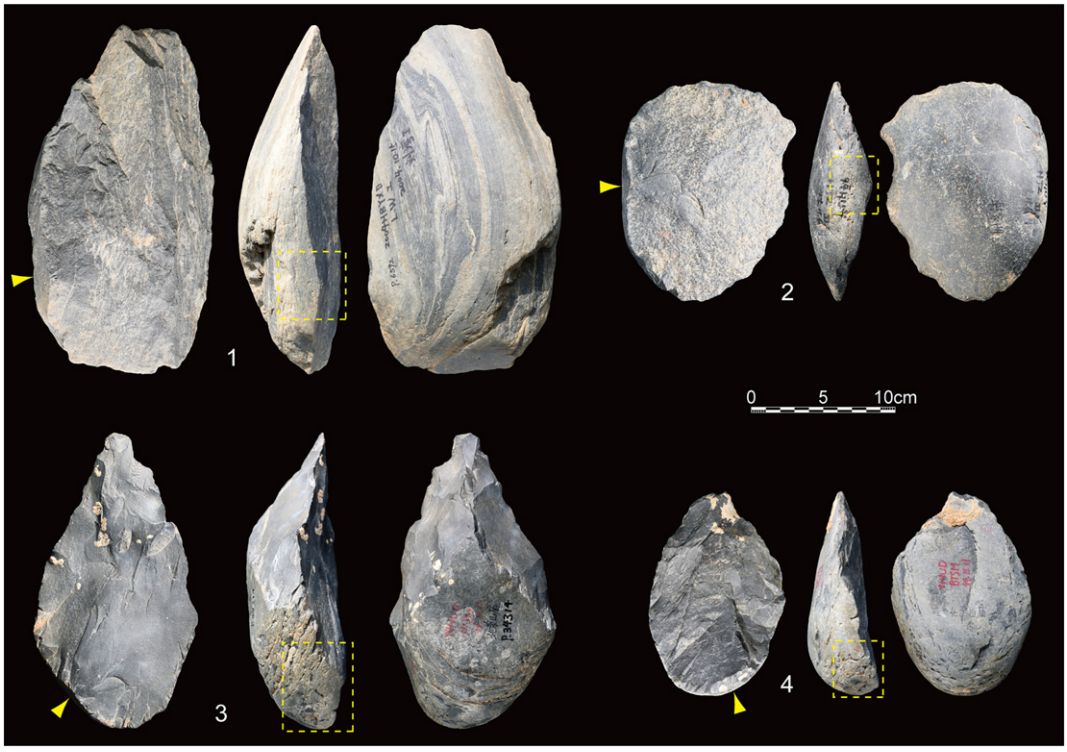


**Fig. 3.** Archaeological examples of cobble opening flakes (1 and 2) and handaxes made on these blanks (3 and 4). Yellow triangles show the striking direction, and yellow rectangles show the cortical striking platform. Numbers 1 and 2 show side-struck flake blanks, and numbers 3 and 4 show a corner-struck and an end-struck flake blank respectively.

**Table 1**
Comparisons of weight and size of raw materials between each two flaking techniques. See SOM Table S2 for raw data.

| | Weight | | Length | | Width | | Thickness | |
|---|---|---|---|---|---|---|---|---|
| | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value |
| Bipolar vs. freehand | 195 | 0.899 | 157.5 | 0.256 | 121 | <0.05 | 182.5 | 0.644 |
| Bipolar vs. anvil | 42 | <0.001 | 73.5 | <0.001 | 7.5 | <0.001 | 63 | <0.001 |
| Bipolar vs. throwing | 100 | <0.05 | 175.5 | 0.516 | 93.5 | <0.05 | 115 | <0.05 |
| Freehand vs. anvil | 53 | <0.001 | 72 | <0.001 | 94 | <0.05 | 43 | <0.001 |
| Freehand vs. throwing | 121 | <0.05 | 136.5 | 0.087 | 190.5 | 0.805 | 104.5 | <0.05 |
| Anvil vs. throwing | 94 | <0.05 | 113 | <0.05 | 87 | <0.05 | 163 | 0.324 |

on the floor—also known as passive hammer technique (Harmand et al., 2015). In the throwing technique, the core is thrown out of the hands towards an anvil on the floor.

The technological and morphological attributes used in this study are presented in Table 2. For large flakes suitable to use as a blank, the technological attributes consist of the type of platform, the presence or absence of the bulb of percussion, and the direction of blow in relation to the long axis of the piece are all recorded (see Fig. 3 for different types of the direction of blow). For morphological attributes, the original weight, length, width and thickness of raw materials are first documented. The same observations are then applied to the detached flakes, regardless of their usefulness or not for making handaxes.

Previous studies of fracture properties for different techniques have revealed that bipolar flaking produces a compression fracture, where force has been applied to both ends of a core, and therefore negative scars or fractures can often (but not always) be observed on both ends of the detached flakes, and a prominent bulb of percussion is absent or diffuse when identified (Lowe, 1946; Cotterell and Kamminga, 1987, 1990; Odell, 2004; Diez-Martín et al., 2011; Gurtov and Eren, 2014; de la Peña, 2015; see Fig. 6 for examples). In contrast, all other techniques in this study (namely, the freehand, anvil and throwing techniques) result in a hertzian fracture, characterized by a prominent bulb of percussion on the ventral face of a flake (see Fig. 5 for illustrations of fracture pattern). Therefore, bipolar flakes are readily distinguished from flakes made by all other techniques used in this study. To document the bipolar technique, experimental flakes produced by this technique were compared with archaeological specimens.

Because it is more difficult to distinguish flakes made by the freehand, anvil and throwing techniques from one another due to the same resulting fracture type, we suggest that it is meaningful to compare the efficiency of each technique in detaching large flakes, as such practical data can suggest the frequency of each in archaeological samples. Here, we use the ratio of successful flaking to indicate efficiency of the technique. For calculating this ratio, we use the number of usable large flakes produced, divided by the number of detached flakes. In particular, we define usable large flakes as those where maximum length is ≥10 cm, maximum width is larger than 5 cm, and maximum thickness is >2 cm. This criterion is derived from the archaeological handaxes made on large flakes, which have an average length of 15.7 cm and only one specimen is <10 cm (see SOM Table S1 for raw data). Our experiments also suggest that these criteria include the smallest sized flakes that can be used to make handaxes.

For the quantitative comparison with archaeological specimens, 105 handaxes were available, but to correspond with the experimental



**Fig. 4.** Hammers and anvil used for percussion. At right is a giant stone used for both anvil and throwing techniques. The yellow circle shows traces of anvil flaking, while red circles show traces of throwing.

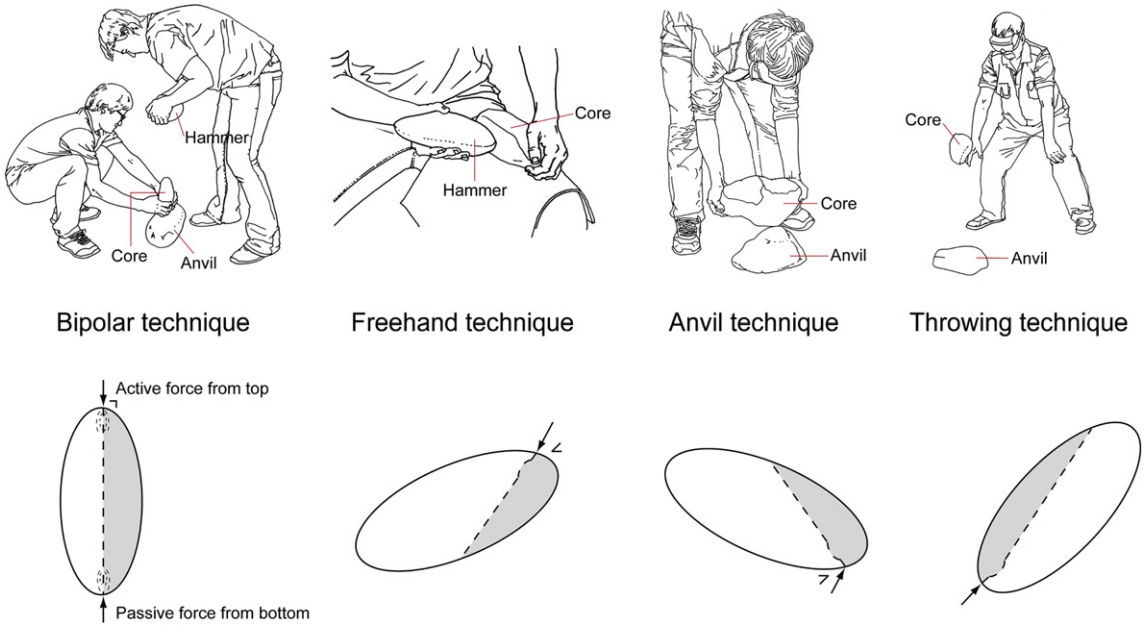


**Fig. 5.** Techniques used in the experimental replications.

design, only those made on large flake blanks (including bipolar flakes) of quartz phyllite were used for this study (N = 36/105; see SOM Table S1 for raw data).

## 3. Results

The experimental data for each technique will not be shown separately, but incorporated in the subsections below to avoid repetition.

### *3.1. Comparison of ratios for successful detaching of large flakes*

Table 3 shows that the bipolar technique has a success ratio of 17:20 flakes (or 85%), and therefore it is the most successful flaking method for quartz phyllite. In contrast, freehand percussion produces the least successful ratio (7:20, or 35%). Anvil (12:20, or 60%) and throwing (11:20, or 55%) techniques have similar proportions, both >50%, and they fall in the middle range of ratios.

A detailed record of the types of failed products in Table 2 shows that the low successful ratio for freehand percussion is mainly due to the small size of products (N = 8; see SOM Table S1 for raw data). This is probably related to the striking action of freehand percussion, where hand-held hammerstones are limited in size and thus do not release sufficient force for this raw material. On the other hand, failed products from the anvil and throwing techniques mainly consist of chunks (N = 10) and split flakes (N = 4). These are probably the result of unintentional breaks along the internal flaws of quartz phyllite (see Fig. 6 for flaws typical of this raw material). In addition, the relatively less accurately control of the desired point of percussion in the anvil and throwing techniques may be another reason for the failed products.

### *3.2. Technological characteristics of experimental large flakes and comparison with handaxes made on large flake blanks*

According to the technological attributes listed in Table 2, only usable large flakes are used for analysis. Our observation first shows that almost all experimental flakes possess a cortical platform, with only one exception, a plain platform flake produced by the anvil technique (Table 4). This is because of flaking failed in the very initial stage and created a plain striking platform for the next detachment. This pattern shown in the platform is generally consistent with the archaeological materials, which also have a high proportion of handaxes made on large cobble opening flakes with cortical platforms (86.7% in Li et al., 2014b). Fig. 3 shows good examples of this kind of handaxe.

For the bulb of percussion, all bipolar flakes show an absence of this attribute (Fig. 6). This contrasts with flakes produced by the anvil technique, which possess a relatively greater number of clear bulbs of percussion (N = 8, 66.7%). Flakes produced by freehand percussion show an intermediate number of clear bulbs (N = 2, 28.6%), and those produced by the throwing technique show an even lower proportion (N = 1, 9.1%; Table 4). Flakes produced by the bipolar technique belong to the compression fracture type and show negative scars or fractures on both ends of flakes and cores in these experiments. The results of our experimental flaking of quartz phyllite fit this principle well, and importantly, further confirm the use of the bipolar technique in the DRR Acheulean samples. Fig. 6 shows the comparison of experimental bipolar products with the archaeological handaxes made on bipolar flakes. They all show features described in bipolar flaking. The other three techniques used in this study belong to the hertzian fracture type, which is characterized by a clear bulb of percussion on the ventral faces of flakes (Fig. 7). Although the proportion of samples with and without a bulb of percussion varies for each technique, we suggest

**Table 2**
Technological and morphological attributes documented in this study. Weight is in grams; length, width and thickness are in mm.

| | Weight | Length | Width | Thickness | Platform type | Bulb of percussion | Direction of blow |
|---|---|---|---|---|---|---|---|
| Hammerstone | X | | | | | | |
| Raw material before reduction | X | X | X | X | | | |
| Detached flake | X | X | X | X | X | X | X |




**Fig. 6.** Examples of bipolar-flaked products (see SOM Table S2 for corresponding numbers). Numbers 6, 7, 8, 9 and 15 show experimental examples of bipolar flaking. In the lower right are examples of DRR handaxes made on bipolar flakes.

this is mainly influenced by the quality of the individual raw materials and the specific motions of each technique in flaking, which we will discuss in detail in the last section. For example, a majority of the freehand experimental flakes lack a bulb of percussion in quartz phyllite.

Regarding the direction of blow, i.e., the position of the bulb in relation to the long axis of flakes, only flakes with a clear bulb of percussion are recorded in Table 4. Results show that for 11 such flakes (two from freehand, eight from anvil and one from throwing), no preferential blow direction can be observed. Four of the 11 are end-struck flakes, two are corner-struck and five are side-struck. The differences in number are likely caused by sample bias. This is consistent with the archaeological materials, in which different types of blow direction can be identified (Kuman et al., 2014; Li et al., 2014b) (see Fig. 3 and SOM Table S1). Fig. 7 shows examples of experimental flakes with different types of blow direction.

### *3.3. Morphological comparison of experimental large flakes with handaxes made on large flakes*

In total, 47 experimental large flakes and 36 archaeological handaxes made on large flakes are used for comparison. Results are shown in boxplots in Fig. 8 and in Table 5. For weight, length and width, both bipolar and non-bipolar experimental flakes have significantly greater values than the corresponding archaeological handaxes (Table 5). This fits the inference that to make a handaxe, a large flake will be reduced to a smaller size and weight during the reduction process. In addition, although the original weight and size of raw materials for bipolar and non-bipolar techniques differ to varying degrees (Table 1), there are no statistically significant differences between bipolar and non-bipolar experimental flakes (except thickness), or between the archaeological handaxes made on bipolar and non-bipolar flakes (Table 5). This may indicate that at least for weight, length and width, the production of handaxes made on bipolar flakes involved a similar reduction process as for handaxes made on non-bipolar flakes.

The exception is the thickness for both bipolar and non-bipolar samples. First, in contrast to weight, length and width, the experimental bipolar flakes have significantly smaller thickness values ($p < 0.05$) than the handaxes made on bipolar flakes (see Fig. 8 and Table 5). We interpret this as a result of a preference for thick bipolar flakes in blank selection. Second, there is no significant difference ($p = 0.668$) in thickness between the experimental non-bipolar flakes and archaeological handaxes made on such flakes (Fig. 8 and Table 5). This is probably an indication that there was no intentional thinning during the reduction of the DRR handaxes.

## 4. Discussion and conclusions

Along with the discovery of new handaxe-bearing sites in China, the study of Acheulean technology is becoming an attractive topic in Chinese Palaeolithic archaeology (Hou et al., 2000; Wang, 2005; Yang et al., 2014; Kuman et al., 2014; Li et al., in press). To supplement the detailed study of excavated materials from the DRR sites, in this paper we have used knapping experiments to explore in depth the technology and associated human behaviour. As a result, the experimental materials in this study provide strong evidence to support our previously published observations on handaxe production technology. They also

**Table 3**
Flaking products and percentages of successful results for each technique. Raw data is provided in SOM Table S2.

| Flaking technique | Number of experiments | Number of usable large flakes | Chunk | Split flake | Small sized flake | Failed flaking | Successful products |
|---|---|---|---|---|---|---|---|
| Bipolar | 20 | 17 | 0 | 0 | 1 | 2 | 85% |
| Freehand | 20 | 7 | 0 | 5 | 8 | 0 | 35% |
| Anvil | 20 | 12 | 4 | 4 | 0 | 0 | 60% |
| Throwing | 20 | 11 | 6 | 0 | 3 | 0 | 55% |

**Table 4**
Technological attributes for the usable large flakes produced in the experiments, according to techniques. Raw data is shown in SOM Table S2.

| Flaking technique | Number of flakes | Type of platform | | Bulb of percussion | | Direction of blow* | | |
|---|---|---|---|---|---|---|---|---|
| | | Cortical | Plain | Absent | Prominent | End-struck | Corner-struck | Side-struck |
| Bipolar | 17 | 17 | 0 | 17 | 0 | 0 | 0 | 0 |
| Freehand | 7 | 7 | 0 | 5 | 2 | 0 | 0 | 2 |
| Anvil | 12 | 11 | 1 | 4 | 8 | 3 | 2 | 3 |
| Throwing | 11 | 11 | 0 | 10 | 1 | 1 | 0 | 0 |

Note: Direction of blow* only documents flakes with prominent bulb of percussion, due to the easily discernible nature on these flakes.

provide greater insight into the flexibility of behaviour by Acheulean hominids in DRR.

### *4.1. Experimental evidence to support the existence of the bipolar technique in the DRR*

A basic distinction between the principles of fracture mechanics is applied to quartz phyllite and allows us to distinguish the bipolar technique from other techniques. As bipolar flaking produces a form of compression fracture, it is characterized by damage shown on both ends of a core by the highly diffused or absent bulb of percussion (Cotterell and Kamminga, 1987, 1990; Odell, 2004; Diez-Martín et al., 2011; Gurtov and Eren, 2014; de la Peña, 2015). The motion of the bipolar technique is shown in Fig. 4. The force received by the cores is from two (bipolar) directions, namely, the active striking force from the top produced by the hammer and the passive force from the bottom created by the stationary anvil. The other techniques (i.e., freehand, anvil and throwing) used in this study are characterized by the hertzian fracture, which in most materials produces a prominent bulb of percussion, but which is more variable in the case of quartz phyllite due to its foliated and often flawed structure. In our previous studies, we identified DRR handaxes made on bipolar flakes according to the features described for compression fractures. Here, our experimental samples using bipolar technique also show these consistent features (see Fig. 6 for examples). This provides further evidence that the bipolar technique was used in the DRR.

It is generally believed that bipolar flaking was widely used to reduce cores too small to hold in the hand and was mainly applied to quartz raw material which is easily shattered (e.g., the well-known Zhoukoudian Locality 1 in China; see Pei and Zhang, 1985). Reports of this technique used to produce Acheulean large flakes are quite rare, and there is no such documentation for it in the other well studied Acheulean regions in China (namely, Bose, Luonan and Dingcun—see Li et al., in press). The use of the bipolar technique in the DRR is closely related to the physical properties of quartz phyllite, which is the dominant raw material in the DRR. The foliated structure and often quite developed internal flaws or faults in quartz phyllite assist in splitting cobbles and make bipolar flaking much easier. The use of the bipolar




**Fig. 7.** Experimental examples of non-bipolar flaking (see SOM Table S2 for corresponding numbers). Numbers 43, 46 and 51 show large flakes detached with the anvil technique; number 75 shows a large flake produced with the throwing technique; numbers 31 and 40 show large flakes produced by freehand percussion. The yellow circles show the prominent bulb of percussion.

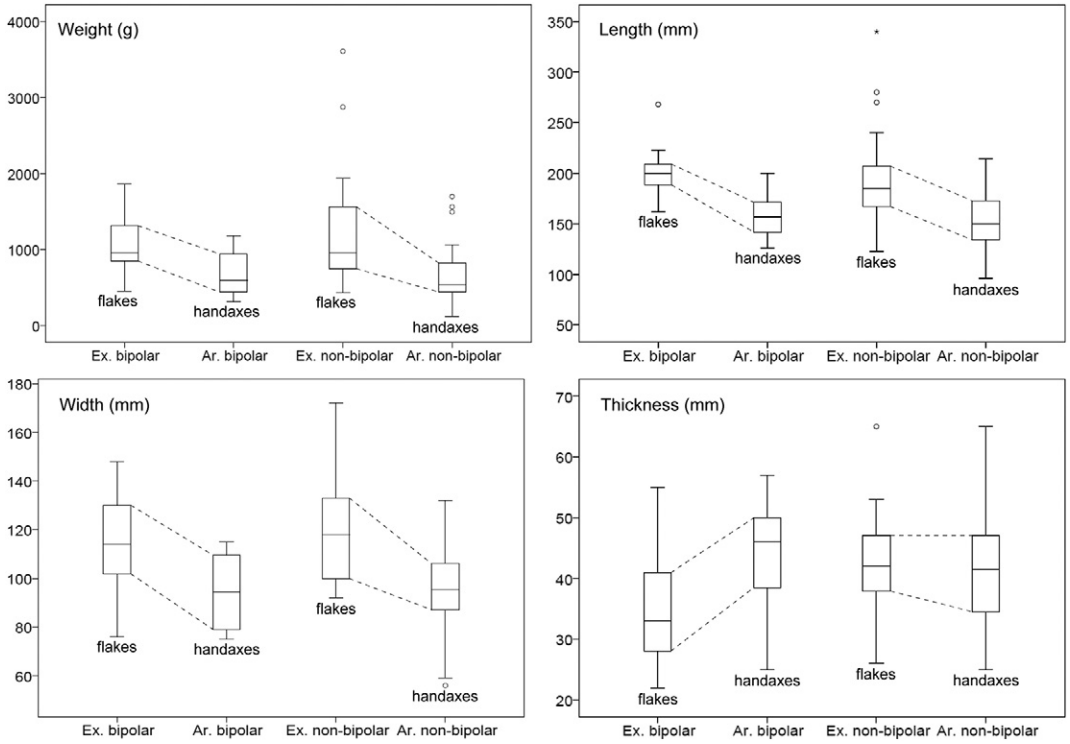


**Fig. 8.** Comparison of bipolar and non-bipolar products between experimental large flakes and archaeological handaxes made on large flakes.

technique is good evidence of the flexible technological solutions used by Acheulean hominids in the DRR.

### 4.2. Other possible flaking techniques used in the DRR

In addition to the unquestionable use of bipolar technique in the DRR, other techniques (i.e., freehand, anvil and throwing) were likely to have been adopted. However, due to the hertzian fracture principle that characterizes all of these techniques, it is more difficult to link a specific technique to individual archaeological specimens. In particular, it needs to be emphasized that although the prominence of the bulb of percussion is regarded as a key feature of a hertzian fracture, it is not always applicable to flakes detached from raw materials with developed flaws or planes. The easily shattered nature of quartz and the foliated structure of quartz phyllite are examples of this. Our experimental data show that flakes produced by the freehand and throwing techniques have a relatively low proportion of clear bulbs, while the anvil technique shows a relatively higher proportion of 66.7%. We suggest that this is either related to the specific striking motion of each technique, or is just simply related to the physical properties of the rock creating variability in this attribute. More experimental data accumulated in future studies will help to answer this question.

Although it may be difficult to identify a specific technique used for some individual flakes or handaxes made from a large flake in DRR, the replications in this study provide information on the effectiveness of each technique, and thus we can infer which technique was probably more frequently used in the DRR. The results show that the anvil and throwing techniques have a higher rate of success (60% and 55% respectively) than freehand percussion (35%) in detaching large flakes. Therefore, we argue that freehand percussion was likely to have been used less in DRR than the anvil and throwing techniques. And interestingly, the anvil technique shows the highest rate of success among these three techniques. This is consistent with some researchers' conclusion that the anvil technique is an effective mode in detaching large flakes (Breuil and Lantier, 1965; Zhang, 1986; Shen and Wang, 2000; Odell, 2004; Mourre and Colonge, 2009–10). Detailed analysis reveals that there are two main causes for producing unusable flakes. The first is the overly small size of flakes produced by non-bipolar techniques, and this is most common in freehand percussion. Only hammerstones of a limited weight and size can be held in the hand, which probably explains the failure, as this kind of hammerstone cannot provide enough force to detach large flakes. Other factors, such as platform depth and exterior platform angle, are also potential reasons in affecting the flake size (Dibble and Rezek, 2009). The second is the accidental breaking of products during flaking, which leads to the detaching of chunks and

**Table 5**
Comparisons of weight and size for experimental and archaeological data. Raw data is shown in SOM Tables S1 and S2. EBF stands for Experimental bipolar flakes; HBF stands for Handaxes made on bipolar flakes; ENF stands for Experimental non-bipolar (i.e., freehand, anvil and throwing) flakes; HNF stands for Handaxes made on non-bipolar flakes.

| | Weight | | Length | | Width | Thickness | | |
|---|---|---|---|---|---|---|---|---|
| | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value | Mann-Whitney U | *p*-Value |
| EBF vs. HBF | 46.5 | <0.05 | 12.5 | <0.05 | 48 | <0.05 | 43 | <0.05 |
| ENF vs. HNF | 133.5 | <0.05 | 163 | <0.05 | 124 | <0.05 | 335 | 0.668 |
| EBF vs. ENF | 250 | 0.917 | 177 | 0.085 | 226 | 0.528 | 125.5 | <0.05 |
| HBF vs. HNF | 106.5 | 0.733 | 107.5 | 0.762 | 143 | 0.98 | 114 | 0.322 |

split flakes. This can apply to all three techniques. The developed foliated structure in quartz phyllite is a likely reason for this high proportion of breaks.

### 4.3. Additional behavioural information inferred from the experimental data

The experimental study described in this paper also provides other relevant information about human behaviour in the DRR. One is the random pattern seen in blow directions, which indicates that blow direction in the DRR was an unintentional behaviour, and that the variety in blow directions is most likely decided by the original shape of clasts. The technological behaviour seen in well-organized core reduction through a desired direction of blow, such as the side-struck flakes detached from Victoria West cores in South Africa (Goodwin, 1929, 1934; McNabb, 2001; Sharon, 2007) and the Chirki core method in India (Corvinus, 1983; Sharon, 2007), was therefore absent in the DRR.

In addition, weight and size comparisons of usable large flakes with the handaxes show that most attributes (i.e., weight, length and width) decreased to a similar extent from experimental samples to the archaeological handaxes, for both bipolar and non-bipolar samples. Therefore, we can speculate that in the following flaking or shaping stage, there was no preference for blanks produced by a specific technique. However, there is a difference in thickness between the experimental bipolar flakes and the archaeological handaxes made on bipolar products. This may indicate a purposeful selection of thicker bipolar flakes to produce DRR handaxes, as thickness in the archaeological materials is even higher than in the experimental samples. For the non-bipolar cases, the values of thickness are similar between the experimental and the archaeological samples, which suggest there is no thinning in the following reduction process.

To conclude, the systematic experimental study in this paper extends our methodology and provides us with strong evidence to support our former observations regarding the DRR, especially the use of bipolar technique in detaching large flake blanks. Moreover, other information about technology and human behaviour in the DRR has been revealed or can be inferred. Experimental analysis in the DRR clearly demonstrates that raw material was a very important factor in the choice of technological strategies employed by ancient knappers. Given that raw materials are highly variable in different regions of the Acheulean in China, we suggest that it is essential to conduct a similar experimental study in each individual region, which will give us a better understanding of the overall relationship between raw materials and flaking technology.

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jasrep.2017.03.032.

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## References

Beyene, Y., Katoh, S., WoldeGabriel, G., Hart, W.K., Uto, K., Sudo, M., Kondo, M., Hyodo, M., Renne, P.R., Suwa, G., Asfaw, B., 2013. The characteristics and chronology of the earliest Acheulean at Konso, Ethiopia. Proc. Natl. Acad. Sci. 110 (5), 1584–1591.
Bordes, F., 1968. The Old Stone Age. McGraw-Hill, New York.
Breuil, H., Lantier, R., 1965. The Men of the Old Stone Age. George G. Harap & Co., London.
Clark, J.D., Kleindienst, M.R., 2001. The stone age cultural sequence: terminology, typology and raw material. In: Clark, J.D. (Ed.), Kalambo Falls Prehistoric Site. vol. III. Cambridge University Press, Cambridge, pp. 34–65.
Corvinus, G., 1983. A survey of the Pravara river system in western Maharshtra, India. The Excavation of the Acheulian Site of Chirki-on-Pravara, India. vol 2. Archaeologica Venatoria: Institut für Urgeschichte, Tübingen, pp. 39–61.
Cotterell, B., Kamminga, J., 1987. The formation of flakes. Am. Antiq. 52, 675–708.
Cotterell, B., Kamminga, J., 1990. Mechanics of Pre-industrial Technology. Cambridge University Press, Cambridge.
Dibble, H.L., Rezek, Z., 2009. Introducing a new experimental design for controlled studies of flake formation: results for exterior platform angle, platform depth, angle of blow, velocity, and force. J. Archaeol. Sci. 36, 1945–1954.
Diez-Martín, F., Yustos, P.S., Domínguez-Rodrigo, M., Prendergast, M.E., 2011. An experimental study of bipolar and freehand knapping of Naibor Soit quartz from Olduvai Gorge (Tanzania). Am. Antiq. 76, 690–708.
Goodwin, A.J.H., 1929. The Victoria West industry. Ann. S. Afr. Mus. 27, 53–69.
Goodwin, A.J.H., 1934. Some developments in technique during the earlier stone age. Trans. R. Soc. S. Afr. 21 (2), 109–123.
Gurtov, A.N., Eren, M.I., 2014. Lower Paleolithic bipolar reduction and hominin selection of quartz at Olduvai Gorge, Tanzania: what's the connection? Quat. Int. 322–323, 285–291.
Harmand, S., Lewis, J.E., Feibel, C.S., Lepre, C.J., Prat, S., Lenoble, A., Boe, X., Quinn, R.L., Brenet, M., Arroyo, A., Taylor, N., Clement, S., Daver, G., Brugal, J.-P., Leakey, L., Mortlock, R.A., Wright, J.D., Lokorodi, S., Kirwa, C., Kent, D.V., Roche, H., 2015. 3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya. Nature 521, 310–316 (Plus Extended Data).
Hou, Y.M., Potts, R., Yuan, B.Y., Guo, Z.T., Deino, A., Wang, W., Clark, J., Xie, G.M., Huang, W.W., 2000. Mid-Pleistocene Acheulean-like stone technology of the Bose Basin, South China. Science 287, 1622–1626.
Isaac, G.L., 1969. Studies of early culture in East Africa. World Archaeol. 1 (1), 1–28.
Inizan, M.L., Reduron-Ballinger, M., Roche, H., Tixier, J., 1999. Technology and terminology of knapped stone. CREP; Nanterre.
Jansen, F.J., 1926. A new type of stone implement from Victoria West. S. Afr. J. Sci. XXIII 818–825.
Kuman, K., Li, C.R., Li, H., 2014. Large cutting tools in the Danjiangkou Reservoir Region, central China. J. Hum. Evol. 76, 129–153.
Li, H., Kuman, K., Li, C.R., 2014a. Re-examination of the morphological variability of East Asian handaxes from a comparative perspective. World Archaeol. 46, 705–733.
Li, H., Li, C.R., Kuman, K., 2014b. Rethinking the "Acheulean" in East Asia: evidence from the recent investigations in the Danjiangkou Reservoir Region, central China. Quat. Int. 347, 163–175.
Li, H., Li, C.R., Kuman, K., Chen, J., Yao, H.T., Li, Z., 2014c. The Middle Pleistocene Acheulean site of Shuangshu in the Danjiangkou Reservoir Region, central China. J. Archaeol. Sci. 52, 391–409.
Li, H., Kuman, K., Li C.R. What Is currently (2017) known about the Chinese Acheulean, With Implications for Hypotheses on the Earlier Dispersal of Hominids. C. R. Palevol http://dx.doi.org/10.1016/j.crpv.2015.09.008 (in press).
Lowe, C.V.R., 1946. The coastal Smithfield and bipolar technique. S. Afr. J. Sci. XLII 240–246.
Madsen, B., Goren-Inbar, N., 2004. Acheulian giant core technology and beyond: an archaeological and experimental case study. Eurasian Prehistory 2 (1), 3–52.
McNabb, J., 2001. The shape of things to come: a speculative essay on the role of the Victoria West phenomenon at Canteen Koppie, during the South African Stone Age. In: Milliken, S., Cook, J. (Eds.), A Very Remote Period Indeed: Papers on the Palaeolithic Presented to Derek Roe. Oxbow Books, Oxford, pp. 37–46.
Mourre, V., Colonge, D., 2009–10. La question du débitage de grands éclats à l'Acheuléen. Paléo, Numéro Spécial 2009–2010 URL:. http://paleo.revues.org/1920.
Odell, G.H., 2004. Lithic Analysis. Springer Science + Business Media, New York.
Pei, W., 1936. Le role des phénomènes naturels dans l'éclatement et le façonnement des roches dures utilisées par l'homme préhistorique. Rev. Géogr. Physique 9, 349–423.
Pei, W., Jia, L., 1958. Lithic industry at the Dingcun site. In: Pei, W. (Ed.), Report on the Excavation of Palaeolithic Sites at Tingtsun, Hsiangfenhian, Shansi Province. China. Science Press, Beijing, pp. 26–55.
Pei, W., Zhang, S.S., 1985. A study of the lithic artifacts of Sinanthropus. Palaeontologia Sinica. Science Press, Beijing.
de la Peña, P., 2015. The interpretation of bipolar knapping in African stone age studies. Curr. Anthropol. 56, 911–923.
Schick, K.D., Toth, N., 1993. Making Silent Stones Speak. Simon & Schuster, New York.
Semaw, S., Rogers, M., Stout, D., 2009. The Oldowan-Acheulian transition: is there a "Developed Oldowan" artifact tradition? In: Camps, M., Chauhan, P.R. (Eds.), Sourcebook of Paleolithic Transitions. Springer, New York, pp. 173–192
Sharon, G., 2007. Acheulian large flake industries: technology, chronology, and significance. British Archaeological Reports International Series 1701 (Oxford).
Shen, C., Wang, S.J., 2000. A preliminary study of the anvil-chipping technique: experiments and evaluations. Lithic Technol. 25 (2), 81–100.
Shipton, C.B.K., Petraglia, M.D., Paddayya, K., 2009. Stone tool experiments and reduction methods at the Acheulean site of Isampur Quarry, India. Antituity 83, 769–785.
Texier, P.-J., Roche, H., 1995. The impact of predetermination on the development of some Acheulean chaînes opératoires. In: Bermúdez de Castro, J.M., Arsuaga, J.L., Carbonell, E. (Eds.), Evolución Humana en Europa y los Yacimientos de la Sierra de Atapuerca. vol. 2. Junta de Castillay León, Valladolid, pp. 403–420.
Toth, N., 2001. Experiments in quarrying large flake blanks at Kalambo Falls. In: Clark, J.D. (Ed.), Kalambo Falls Prehistoric Site. vol. III. Cambridge University Press, Cambridge, pp. 600–604.
Wang, S.J., 1989. An experimental study of large flake reduction at the Xiaokongshan site. Prehistoric Study. 1, pp. 245–259.
Wang, Y.R., 2004. Comments on experimental study of anvil technique and flakes produced by it. In: Chen, X.C., Deng, C. (Eds.), Celebration of the Eightieth Birthday of

Professor Zhimin An. The Research Center of Chinese Archaeology and Art in the Chinese University of Hong Kong, Hong Kong, pp. 22–29.
Wang, S.J., 2005. Perspectives on hominid behaviour and settlement patterns: a study of the Lower palaeolithic sites in the Luonan Basin, China. British Archaeological Reports International Series 1406 (Oxford).
Yang, S.X., Huang, W.W., Hou, Y.M., Yuan, B.Y., 2014. Is the Dingcun lithic assembly a "chopper-chopping tool industry", or "Late Acheulian"? Quat. Int. 321, 3–11.
Yang, S.X., Hou, Y.M., Pelegrin, J., 2016. A Late Acheulean Culture on the Chinese Loess Plateau: the techno-economic behavior of the Dingcun lithic industry. Quat. Int. 400, 73–85.
Zhang, S.S., 1986. Chinese Palaeolithic Cultures. Tianjin Science and Technology Press, Tianjin.

# CHAPTER SIX: DISCUSSION AND CONCLUSIONS

The research in this thesis brings more information with regards to lithic raw material selection in the Earlier Stone Age, using two sites in South Africa for the Oldowan and Early Acheulean, and one large Acheulean site in central China. The methodology, which incorporates experimental knapping as an important component, successfully provided insight into raw material selection from the ESA spanning different continents. Making use of extensive sourcing of available rock sources, taking note of important landscape features and utilising experimental knapping have proved to be useful in studying raw material selection for ESA sites. This methodology can also be applied to MSA and LSA sites but might need additional data determining rock sources, as later sites often source rocks from great distances (>10 km), whereas rock sourcing at most ESA sites are often within a 10 km radius of a site. Human behaviours for later time periods also become more complex, such as heat treatment of stone (Schmidt *et al.* 2013; Wadley and Prinsloo 2014; Zhou *et al.* 2014; Schmidt *et al.* 2015; Schmidt and Högberg 2018) and trade (Nash *et al.* 2013, Nash *et al*. 2016; Will and Mackay 2017), which must also be considered in raw material studies for these sites.

The research questions presented in Chapter one will be answered and discussed below for each study. A comparison with research findings from other ESA and middle Pleistocene sites will also be made and general conclusions will then be drawn about hominid behaviours through time.

## 6.1 Answers to the research questions in this thesis

### Study 1

1. *Is selection for raw material quality present at Sterkfontein, as has been shown for the Swartkrans Oldowan and Acheulean?*

There is selection for quality of rock present at both Sterkfontein and Swartkrans, for both the Oldowan and the Acheulean. Hominids predominantly selected specific rock types (quartz, quartzite and chert) from the 12 that are available. In addition, they selected better qualities of these rock types by avoiding ones that were too flawed and weathered. Fine grained varieties

of the quartzites were also selected. These selective practices were present for both the Oldowan and the Acheulean, at both sites.

2. *If there are selective differences between the two sites, what reasons could explain their existence?*

There is greater selection for the quality of raw material at the Sterkfontein site, which is true for both the Oldowan and the Acheulean, than there is at Swartkrans. However, it is important to comprehend the palaeo-environments and landscapes of the Blaaubank River valley to help contextualize rock selection behaviours for the different techno-complexes. Botanical remains in Member 4 at Sterkfontein suggest that the environment between 2.8 and 2.6 Ma, prior to the tool-bearing deposits, was moist with a dense tropical to subtropical gallery forest surrounding a river (Bamford 1999a, b; Kuman & Clarke 2000). Deposited faunal remains (ca 2.8 - 2.6 Ma) from woodland, open woodland and grassland habitats indicate that these landscape components were also present not too far from the site (Kuman & Clarke 2000). A study conducted on carbon isotope ratios of bovid fossils from Sterkfontein indicated that the environment consisted of medium density woodland during the Oldowan, which is now dated ca 2.18 Ma (Granger *et al*. 2015). The environment became markedly open around 1.7 Ma (Luyt and Lee-Thorp 2003). The increase in faunal remains adapted to open woodland and grassland habitats deposited at Sterkfontein around 1.7 - 1.4 Ma and Swartkrans between 1.7 - 1 Ma indicate a trend towards a drier climate around this time (Kuman & Clarke 2000). Furthermore, faunal remains of some water-dependent animals are present at Kromdraai around 2 - 1.5 Ma and at Swartkrans around 1.8 - 1 Ma (Kuman 2007), indicating that between ca 2 - 1 Ma the Blaaubank River was robust enough to support large water-dependent animals, and would have been an attractive place for hominids, prey and predators. The course of the current Blaaubank River runs roughly from East to West and separates the Swartkrans site from Sterkfontein. This was likely also the case ca 2 Ma, as the placement of the preserved gravels run parallel to the current Blaaubank River (Sherwood 2013). A possible explanation for better quality selection seen at Sterkfontein during the Oldowan is possibly related to the palaeo-environment at that time, and the locations of each site relative to the primary gravel source. The Swartkrans site is very close to this source, whereas Sterkfontein is further away from the nearest gravels (300m distance and more), and thus materials would have needed to be transported a further distance to the Sterkfontein site, meaning that poor selection of material would result in a wasted trip. Other factors may have

contributed, such as predators lurking in the woodland near Swartkrans, which might have limited the time for selective decisions. Availability of raw material sources through time should also be considered (Dibble 1991), as these materials may have been less accessible during certain occupations at either site. The Swartkrans Oldowan (Sutton 2012; Kuman *et al*. 2018) and the Member 2 Acheulean technologies are possibly more expedient than similar technology found at Sterkfontein (Field 1999), which could also be as a result of being at risk closer to the river at Swartkrans, as not only was it a steep, densely vegetated terrain (Pickering 2002; Pickering *et al*. 2004; Pickering *et al.* 2008), but leopards frequently occupied the area and often prayed on *Paranthropus* (Brain 1981; Brain 1993). This could also explain the larger amount of manuports found at Swartkrans during the Oldowan and the Member 2 Acheulean occupation, as rocks would likely have been stockpiled for future use (Field 1999). It is also possible that Swartkrans captures test knapping of various materials or the undesired by-products of knapping and hominids took the better flakes, cores or LCTs with them somewhere else on the landscape. Few formal tools and LCTs are present at Swartkrans during the Acheulean indicating that this is also likely the case during the Acheulean.

The problem with time averaging at sites is that it makes it difficult for archaeologists to determine specific behavioural patterns in an assemblage, as multiple occupations spanning many hundreds or thousands of years appear synchronous in the geological record (Brantingham 2003). Thus, the quality differences at Sterkfontein and Swartkrans may be more complex than what we can observe. For example, there may have been an occupational period at Swartkrans that shows better selection than some occupations at Sterkfontein, which are represented by a handful of better-quality tools in the assemblage. It is however difficult to determine specific occupations given the depositional nature of these cave systems, and thus assemblages of a specific technocomplex (Oldowan or Acheulean) are studied as one, with the assemblage providing the average of the occupations. It is important to note that behaviour was almost certainly more complex, as environments change over millions of years and different groups of early hominids would have consisted of differing individuals who would have influenced selective decisions. However, see Byrne (2004) where climatic conditions do not always result in differing behaviour or lithic reduction techniques over different occupations, as seen at the Middle Pleistocene (570-400 ka) site of Arago cave, Tautavel (Pyrénées-Orientales in France), where technology and raw material acquisition remain fairly consistent in all layers of the site, despite changes in climate.

3. *Overall for the two sites, is there an increase in quality selection during the Acheulean, compared to the Oldowan?*

There is an increase in the selection for the quality of material during the Acheulean at both sites, but this was only seen in the averages for each variable, whereas the statistical tests were not significant enough to conclude this with absolute certainty.

4. *What does this data add to our current understanding of hominid behaviours?*

This study confirms that the ESA hominids at these sites understood rock properties fairly well and knew that certain rock types are better for tool manufacture and use. They were also capable of selecting for the quality of these different rock types even though they did not always do so. They understood that certain materials, their shapes and or sizes might need different knapping techniques to produce flakes more frequently and successfully. Acheulean hominids also understood that certain materials were better to use for the creation of LCTs, such as quartzite being preferred over quartz and chert, as it produced large flakes more consistently, held a durable edge and most LCTs were made in this material. Manuports are also present, especially during the Acheulean, indicating they had the capacity for foresight and planning.

5. *How have extensive knapping experiments aided this study?*

The experimental knapping of lithics helped to explain differences in the properties of materials available at the site locations relating to both tool-making and use. It also aided in understanding how flaws affect the flaking process and thus helped to isolate variables for analyses that could be identified visually from a knapper's perspective. These variables were determined using extensive knapping of the various materials, and they were used to gather more data for the Swartkrans Oldowan, in the experimentally created lithics and the Sterkfontein Oldowan and Acheulean, which could then be used for comparisons between the two sites. Use of each of the various materials also indicated which raw material types were best for specific tool functions. It was determined that quartzite, quartz, diabase and chert were the best of the 12 materials available for use, due to a combination of high flaking predictability, durability and sharpness. These four materials were the ones selected for the

production of stone tools at both Swartkrans and Sterkfontein. Diabase, however, was used in very small proportions, despite a high durability and sharpness. Knapping of this material revealed a possible reason for why this material was not as frequently selected. This rock type is incredibly hard and requires immense force to flake, as opposed to the three other materials that were selected. Using more force to flake a material decreases the accuracy of impact by the knapper as a larger swing further away from the impact area is often required, and thus flaking predictability is reduced. This material can be flaked by a skilled knapper, but a lack of selection for this material does not indicate a lack of hominid cognitive complexity or skill. In fact, it could indicate the presence of skill and higher cognition, as it makes more sense to select materials that will effectively function as tools and are easier and more predictable to flake, thus putting in less energy for the same end result. The knapping experiments also helped in gaining an understanding of the complexity of selection with regards to flaws in the materials. Extensively flawed materials proved to be more trouble to flake than was worth the energy and effort. In addition, extensive selection for materials that entirely lacked flaws also took time and energy. Materials that had a flaw or two proved to be easy enough to predictably flake when using knapping skill to circumnavigate flaws or to strategically flake a material, such as directing an impact down a joint to force a flake to break off along that joint. This required less effort to knap than extensively flawed material and takes less time to select for than perfectly flawless material. It thus makes sense that selectivity was present during the Oldowan, but materials still had flaws present, as it might have been risky for hominids to extensively select for flawless materials, as staying too long in one place might attract predators (river). Thus, a balance between energy required to select, knap and utilise material was likely obtained that suited their unique survival situation best. The slight increase in selection of quality during the Acheulean can also be explained from the knapping experiments. LCTs in particular required reasonably good quality material to create, as opposed to flakes for example. In addition, the best material to create an LCT from was quartzite, as quartz and the kind of chert available at the sites tend to be unpredictable when shaping into a large tool. This is seen in the Sterkfontein assemblage as most LCTs were made from quartzite and had a low impurity encounter rate. There were unfortunately not any *in situ* LCTs from Swartkrans to draw any conclusions on.

**Studies 2 and 3**

1. *Is there selection for raw material quality in the DRR?*

Middle Pleistocene hominids living around Terrace 3 of the Danjiangkou Reservoir Region favoured a particular type of rock for the creation of LCTs that was available in abundance (quartz phyllite), but one which exhibited the highest number of flaws. However, hominids did practice quality selection for lithic raw material, as the randomly collected sample of this material exhibited significantly higher abundance of flaws present than the ones used to make artefacts. Selection for other materials was also practiced for the creation of smaller tools, as these consist predominantly of quartz (Li *et al*. 2014a), which is a rarer material in the natural gravels. The reasons for selection of quartz phyllite for LCTs are fairly complex, and are discussed below.

2. *How have extensive knapping experiments aided this study and what technological behaviours can be inferred from the results?*

Experimental knapping of the various raw materials available at the sites was essential for determining why the hominids in this area selected such poor-quality material for the creation of LCTs. Good quality materials, such as quartzite and igneous varieties, were rarely used likely due to the effort it took to knap these cobbles into LCTs, as compared to the quartz phyllite cobbles, which flaked with ease despite the abundance of flaws present. Quartzite and igneous material took considerably more force to shape into LCT's due to the hardness of these materials. As noted for study one, when more force is required to dislodge a flake the accuracy of one's strike is reduced, making the shaping of LCT's more difficult, but flaking can be accomplished with sufficient skill and patience. Knapping experiments also demonstrated that weathered material had reduced flaking predictability. Flaking weathered material resulted in flakes not being as invasive, which are essential for the initial shaping of an LCT. In addition, cutting edges of such tools were often more brittle and thus not as durable as their unweathered counterparts, with only surface weathering up to 1mm. Both quartzite and igneous material were more susceptible to weathering than the quartz phyllite, especially if cobbles were well rounded and thinner (disk or amygdaloidal in shape), which made up a sizable proportion of the natural gravels.

Initial cobble shapes were also selected for and proved to be important, as the shape of a cobble formed the blueprint for the creation of a functional LCT. Certain shapes were more effective for creating LCTs than others. The majority of gravels were polyhedral or wedge-like in shape, but amygdaloidal, disk, tablet, amygdaloidal tablets and rods were more often selected for. These shapes proved to be best for the creation of LCTs as they were often flatter/thinner and thus had a more accessible starting platform, with rods being the exception. However, rods were selected and split into two halves via bipolar knapping to provide the knapper with a starting platform and two flatter pieces already resembling the rough shape of an LCT. LCTs made from large flake blanks acquired via bipolar flaking are generally uncommon in China, but a large proportion of LCTs from the DRR was made on bipolar flake blanks, as determined via experimental investigations (Kuman *et al*. 2014), thus showing the diversity and flexibility of the Acheulean technology in this region. The unique nature of the flaws in the quartz phyllite was advantageous here as there is parallel banding in this material, which is often along the longitudinal axis of a cobble, making splitting this material easy and with minimal effort. In addition, this material flaked very easily due to its siliceous cryptocrystalline matrix, as little force was needed to detach flakes, which also facilitated the splitting of large cobbles. Banding did occasionally compromise further shaping of an LCT, but with repeated knapping of the material it became easier to predict flaking and how to use the inherent banding to one's advantage. The DRR LCTs were not extensively shaped, with a few initial large removals to achieve the general shape, and most of the flaking was directed to the shaping of the tip or the working edge (Li *et al.* 2014b). This would minimize compromising the entire LCT, as extensive flaking could eventually result in the tool breaking unfavourably when encountering a flaw during knapping. The experimental knapping made it clear that the banding mostly affected the initial large removals, but rarely affected smaller removals around the edges of a tool. Use of some of the experimentally created LCT's furthermore indicated that quartz phyllite also had the most durable and sharpest edges of all the available materials, which is likely due to its substantial content of cryptocrystalline silica, and potentially metals from the original rock (shale/mudstone) that had undergone metamorphism. Experiments also indicated that all available materials could be shaped into refined LCTs, but this was likely not done due to the abundance of materials available, and there was no need for tools with long lifespans. It is also possible that this industry was more expedient in nature, and thus extensively shaped or refined tools were not important.

These DRR studies showed that raw material selection is very complex and that later hominids were adaptable and could make strategic decisions with regards to the raw materials available to them. It also shows the importance of extensive knapping experiments to get a better grasp of raw material selective decision.

*3. What does this add to our current understanding of hominid behaviours?*

Middle Pleistocene hominids living in central China, like ESA hominids living in Africa, had an understanding of raw material behaviour and practiced selection for particular materials for the creation of LCTs. Despite the flawed nature of the materials favoured there was selection for quality, as quartz phyllite cobbles were selected that on average had fewer flaws present than what can be obtained at random. Hominids were complex enough cognitively to realise that the nature of the flaws in this material can be used advantageously and that this was the best material to create the most effective LCTs with the least amount of effort. Different knapping techniques (occasional bipolar) were implemented, indicating they had a sufficient understanding of rock flaking and differing rock mechanics. These two studies showed that hominids living in Asia were more complex than first believed, and that raw material "quality" or the unrefined nature of tools should not be a sole determiner of hominid behavioural complexity, but that closer investigations of assemblages are required.

## 6.2 Early hominid behaviour

The behavioural complexities that modern humans exhibit appeared gradually over the course of our evolution, not in a linear fashion, but more like a complex web (McBrearty and Brooks 2000). Early hominids present more technological and cognitive complexity than modern great apes (orangutan, chimpanzee, bonobo and gorillas), and thus their industries represent a transitional cognition between great apes and *Homo sapiens* (Toth and Schick 2018). We do not know much about early hominid behaviour prior to the Lomekwian, as only fossils are preserved from this pre-stone tool time period. It is possible that early hominids used rock to crush nuts and seeds, much like certain groups of chimpanzees do today (Luncz *et al*. 2018; Proffitt *et al.* 2018). Very little is known about the behaviours of our ancestors living 3.3 Ma during the Lomekwian, which will likely improve over time if more Lomekwian or other such early sites are discovered. However, we do see the first appearance of deliberate creation of stone tools. Flakes were obtained from large cores that were struck against anvils,

bipolar flaking and the occasional freehand flaking (Harmand *et al*. 2015). Selection for the sizes of cores and anvils may have been present and possibly the types of rock, however, this is yet to be confirmed with further studies.

Detailed research on lithic raw material quality has been performed on Oldowan assemblages. Comparisons can prove to be complicated as there is a diversity of methodologies employed to describe selection during this industrial complex. Assemblages in East African Oldowan sites consist of different materials (predominantly igneous) than the ones used for stone tool making in South Africa. This makes direct comparisons of findings even more difficult, but some patterns are evident. Selection for lithic quality is present during the Oldowan in Gona and Makaamitalu Basin, showing selection of fine-grained rocks with smaller and fewer crystal inclusions (Stout *et al*. 2005; Stout *et al*. 2010; Goldman-Neuman and Hovers 2012). The shape of a blank could also have been an important contributing factor as some selection for this is seen (Delagnes and Roche 2005; Stout and Semaw 2006). Hominids at Kanjera South selected material that had durable edges over material with higher fracture predictability, but rock types that were both durable and predictable were preferred (Braun *et al*. 2009). The selection at Sterkfontein and Swartkrans reflects some similarities as finer grained material was often used, as well as rocks that were both predictable and durable. Oldowan hominids in both east and southern Africa very rarely selected raw materials beyond several to 10 km from a site, and thus they did not expend a lot of energy hunting for raw materials that were exceptionally rare and of high quality (Negash *et al.* 2006). Their needs were easily met with local rocks that were decent enough to create useful flakes that did not have to be top quality. Early hominids also tended to make and use tools expediently, further demonstrating that they did not expend energy unnecessarily. For example, it makes little sense to exploit a high-quality chert from 50 km away when a quartz cobble in the vicinity will do for a quick task. Later humans would sometimes carry pre-flaked material (Lengyel 2015) with them that were selected or traded from a source much farther away and often of higher quality. It is not clear if early hominids also practiced this over large distances, as it is not clearly seen in the archaeological record. Stone caches do however exist at some sites in the form of manuports that were carried to a site location, but never knapped. Knapping strategies are already fairly complex during the Oldowan, including freehand hard hammer percussion and bipolar reduction. These techniques are seen to some extent during the Lomekwian (along with striking rock against anvils) but with less

accuracy (Harmand *et al*. 2015). Free hand percussion, especially, offered more control of flaking and thus more accuracy.

Only a few studies extensively compare raw material quality selection between neighbouring sites to add to selection behaviours in similar habitat and geological settings. Goldman-Neuman and Hovers (2012) compared two late Pliocene Oldowan sites at Makaamitalu Basin (Hadar, Ethiopia), A.L. 666 and A.L. 894. Selectivity was present to some extent at both sites, but the slightly younger of the two sites, A.L. 666, shows greater selectivity of better-quality materials. Unlike Sterkfontein and Swartkrans, the two sites are a similar distance to raw material sources, and thus the difference in selectivity at A.L.666 is likely due to other factors. McHenry and de la Torre (2018) compared lithic raw material quality for two assemblages at the Oldowan-Acheulean transition in Bed II of Olduvai Gorge, Tanzania. One late Oldowan sites (HWK EE) and one early Acheulean (EF-HR) site were studied. Selection at HWK EE was predominantly for the blank shape of a rock and availability of natural angles suitable for flaking. The Early Acheulean site EF-HR, however, showed that hominids selected high quality fine-grained lavas for the production of LCTs, showing increase selection during the Acheulean, much like at Swartkrans and Sterkfontein.

The Acheulean shows the appearance of LCTs, which involve more complex reduction strategies than that of simple flake production. Selection for better material is thus seen to some extent during the Acheulean and some materials are selected from further away (Deacon and Deacon 1999; Braun *et al.* 2013). Evidence for the use and control of fire also makes an appearance in the archaeological record during this time period, indicating another aspect of hominid cognitive complexity. The later Acheulean, especially in Europe, shows more selection for better quality materials (Lamotte *et al*. 2017) and a general trend to better refinement of LCTs (although see McNabb and Cole 2015). Soft hammer percussion is more apparent in the later Acheulean (Méndez-Quintas *et al.* 2019) and longevity of tools is generally more important, as is apparent from more extensive retouch and reuse. Hominids also show a remarkable ability for adaptability to varying circumstances, as is seen in the DRR.

It is apparent that Middle Pleistocene hominids living in the DRR made strategic selective decisions with regards to the raw materials they utilised for the creation of tools, despite not having the best raw materials to select from. Quartz was used predominantly for small-to-medium sized tools, but it was not a good material to successfully create LCTs consistently.

The hominids thus opted for quartz phyllite, which despite being heavily banded proved to be the best material for the creation of LCTs. Selection of this material might also have affected the knapping strategies employed to create LCTs, as more extensive focus was given to shape a working edge than the overall refinement of an LCT's shape. Similar behaviour is seen at the Middle Palaeolithic site, Tsagaan Agui cave Lower Grotto, in northeast Asia, Mongolia, where despite the local chert exhibiting heavy banding the people simply adjusted their flaking strategies to prepare cores (Brantingham *et al.* 2000).

Stone technologies in China have often been seen as more expedient and made of poor-quality materials. Shuidonggou locality 2, north China (42-27 ka), shows expedient use of pebbles from local river beds. This is likely because the area had both an abundance of food and rock sources, thus spending excessive amounts of energy and time to procure exceptional quality rock is unwarranted. "In sum, the persistence of comparatively simple and expedient lithic technology in north China until around 25 ka could be both an active response to local environments in which raw materials and food could generally be found in the same places, and a by-product of resource distributions which channelled human foraging movement along linear drainages" (Li *et al.* 2016: 91). Despite a stasis in the technology of Late Palaeolithic site of Shuidonggou Locality 2, selection is seen for raw material (Lin *et al.* 2019). Early Pleistocene sites in the Nihewan Basin, northern China, show simple but adaptive strategies, demonstrating that hominid behaviour in Asia is more complex than originally thought (Lui *et al.* 2013). Study two in this thesis indicates that it was indeed possible to create "refined" LCTs from the available materials at DRR. This indicates that the lack of extensively shaped LCTs in Asia is not due to the overall poorer quality raw materials available, as compared to flints and cherts found in Europe for example. Shaping the LCTs extensively did require more skill, patience and energy to create, but could perform similar tasks to LCT's not extensively shaped. As mentioned previously the lack of extensively shaped LCT's at DRR does not indicate a lack of complex thinking in this region, as particular raw materials were selected and strategically knapped. It was probably not necessary to expend the energy to create "refined" LCTs, as raw materials were abundant and these LCT's may have only been required for expedient tasks, thus not demanding the extra energy to create.

Behaviours discussed above are briefly summed up below for reference purposes. It should be noted that this list does not indicate a linear progression of behaviours, but it does show a general increase in complexity over time. However, only four samples were compared for the Oldowan and the Acheulean change and much more and larger comparisons would need to be

studied to address the complexity of progression of behaviours from the Oldowan to the Acheulean in greater detail. It should also be noted that it does not show absolutely every behaviour of our ancestors, as that is a thesis on its own. It pertains to the predominant behaviours studied with regards to raw material selection, tool knapping and use that are visible in the archaeological record during the early Palaeolithic.

Oldowan:

- Selection for rock type is often seen.
- Selection for the size of cobbles and cores is apparent.
- Selection for the initial shape of a core might have been practiced.
- Selection for quality of rock is seen in some assemblages.
- Rocks were generally acquired from the local environment (distances <10 km from a site).
- Caches of unknapped material or manuports do exist at some sites.
- Knapping strategies changed from mainly striking rock against anvils at 3.3 Ma to predominantly freehand hard hammer percussion. These techniques offered more control of flaking and thus more accuracy.
- More variety in core reduction strategies is seen than the Lomekwian.
- Generally expedient technology with occasional retouch and reuse was practiced.

Acheulean:

- All of the above behaviours that are seen in the Oldowan are present, with the addition of LCTs, which involve more complex reduction strategies than that of flake production.
- Evidence for the use and control of fire makes an appearance in the archaeological record.
- Soft hammer percussion is more apparent in the later Acheulean as well as the use of better-quality rock material.
- Longevity of tools is generally more important as is apparent from more extensive retouch and reuse.

## 6.3 Conclusion

By 3.3 Ma our hominid ancestors understood that sharp flakes from a rock can be used as a tool and had enough capacity to realise they can actively create such flakes by striking a large rock against another freestanding rock (anvil) and with freehand percussion. It is possible that rock selection already began during the Lomekwian for durable and sizable cobbles of igneous rocks that were effective enough to create large durable flakes as tools (Harmand *et al*. 2015). This gave our hominid ancestors a better chance at survival, which drove them to try out different materials and better more accurate knapping techniques, thus giving birth to the Oldowan technology. The selection of specific rock types during the Oldowan and the more frequent use of freehand hard hammer percussion likely led to its success and thus led to its widespread use (Stout *et al*. 2005). Hominid minds were already complex by the Oldowan, indicating an understanding that certain rock types are better for making stone tools than others. They could visually identify these rock types, but were also capable of understanding that certain attributes or flaws found in rocks could hinder the knapping process or use as a tool, and often avoided rocks that had too many of these flaws or attributes present. Early hominids also understood the importance of the shape and size of rocks used for the initial core (Delagnes & Roche 2005; Goldman-Neuman & Hovers 2012). Other behavioural complexities include the deliberate retouch of tools, curation and transport of stone and the processing of large animal carcasses (Toth and Schick 2018). The continued use of stone tools later led to more and more complex knapping techniques and tools, which often required better material to be selected for, such as for prepared cores. The exception being the lower Palaeolithic Victoria West industry found in South Africa (Lycett *et al*. 2010; Li et al 2017b), which were prepared cores made for handaxe blanks and made from fairly touch igneous material that is difficult to knap (personal experimentation with Ventersdorp andesites) This industry is however a perfect example of how hominid progression was complex and not linear. The Victoria West industry is essentially a prepared core industry and is approximately 1 million years old, thus it predates the prepare cores technology which is seen during the MSA 800 000 years later (Li *et al*. 2017b). Hominids were thus capable of the kind of thinking required to create prepared cores long before the MSA, even though the practise of it was not widespread till the MSA. This is also an example of when good quality material was not present hominids had the capacity to adapt and alter their flaking strategies, or even use inherent flaws within rocks to their advantage as is seen in the DRR.

Raw material studies are thus important for us to help understand these behavioural complexities of the hominid mind and their adaptability from various time periods and regions of the world. Moník and Hadraba (2016) argue that geochemical and mechanical testing methods used to test certain raw material attributes do not suffice when on their own, as multiple factors contribute to raw materials being a better quality for knapping and tool use. For example, diabase is harder and more durable than flint, thus making it the "better" material for tool creation. However, knapping diabase is much more difficult than flint due to its exceptional hardness (personal experimental flaking of both materials). Removal of sizable flakes from diabase requires a lot more strength than with flint, this extra strength comes from a percussive blow that is a greater distance from the platform, which can in turn affect the accuracy of the knapper's strike. Moník and Hadraba (2016) suggest that, for this reason, dynamic tests should be employed to measure raw material quality. Using only geochemical and mechanical tests, even a multitude of them, does not always suffice when trying to understand complex adaptive behaviour employed by hominids. This is why utilising experimental knapping in studies are important for gaining experience with certain material in an actualistic way. In addition, a knapper would experience a material's quality in a holistic fashion, with all the various characteristic of raw material quality working together. Factors that mechanical and geochemical tests cannot account for are things like impact absorption and direction of force in a flexible, movable humanoid hand, skill and problem solving, among many. This is why experimentation was implemented and focussed on in the studies within this thesis. The methodology and techniques set out in this thesis can be used on any Stone Age site and could provide valuable insights into human and hominid selective behaviours with regards to the lithic raw material used for making stone tools. The set of studies shows us how complex raw material selection can be and how many factors need to be considered, as well as how they work in combination. By including experimental knapping of the same materials and selecting variables unique to the geology of a particular site, one can determine selective behaviours practiced at a site from a more holistic and actualistic viewpoint. A limitation to such a study is that one would need to be (or hire) a proficient knapper to be able to replicate tools from assemblages being studied and to have that first-hand experience with the variety of rocks used. Experimental studies like this also have an element of subjectivity. Future studies over time will help to refine the methodology used in this thesis as different sites and time periods are incorporated. In addition, more research done on raw material selection for sites not yet studied will make our understanding of hominid and human raw material acquisition and use clearer. Future developments in the

field are already underway with technologies advancing and now becoming closer to being incorporated into the field of archaeology more consistently. Surveying techniques such as LIDAR, infrared and hyperspectral devices are becoming more accessible and can fit onto drones, which make surveying much more effective than on foot (Parcak 2019: 165-184). These kinds of surveys can be useful for potentially finding new sites as well as giving environmental contexts to sites, such as discovering raw material sources and ancient watercourses that are covered by modern sediments (Parcak *et al.* 2016). This will help us to better understand hominid behaviours and give more information and context over the next few decades to help us understand human cognitive development over time, which will help us understand our own origins and development as a species.

**REFERENCES**


Ambrose, S.H. 2002. Small things remembered: origins of early microlithic industries in sub-Saharan Africa. In: Elston, R., Kuhn, S. (Eds.), *Thinking Small: Global Perspectives on Microlithic Technologies*. Archaeological Papers of the American Anthropological Association No. 12, pp. 9 - 29.

Ambrose, S.H. 2006. Howiesons Poort lithic raw material procurement patterns and the evolution of modern human behaviour: a response to Minichillo (2006). *Journal of Human Evolution* 50: 365 - 369.

Ambrose, S.H., Lorenz, K.G. 1990. Social and ecological models for the Middle Stone Age in southern Africa. In: Mellars, P. (Ed.), *The Emergence of Modern Humans*. Edinburgh University Press, Edinburgh, pp. 3 - 33.

Andrefsky, W. 1994. Raw-material availability and the organization of technology. *American Antiquity* 59(1): 21 - 34.

Alperson-Afil, N., Richter, D., Goren-Inbar, N. 2007. Phantom hearths and the use of fire at Gesher Benot Ya'aqov, Israel. *PaleoAnthropology* 1 - 15.

Alperson-Afil, N., Goren-Inbar, N. 2010. *The Acheulian Site of Gesher Benot Ya'aqov Volume II: Ancient Flames and Controlled Use of Fire*. Springer, London.

Avery, D.M. 2003. Early and Middle Pleistocene environments and hominid biogeography; micromammalian evidence from Kabwe, Twin Rivers and Mumbwa Caves in central Zambia. *Palaeogeography, Palaeoclimatology, Palaeoecology* 189: 55 - 69

Backwell, L., d'Errico, F. 2001. Evidence of termite foraging by Swartkrans early hominids. *PNAS* 98(4): 1358 - 1363.

Backwell, L., d'Errico, F. 2003. Possible evidence of bone tool shaping by Swartkrans early hominids. *Journal of Archaeological Science* 30(12): 1559 - 1576.

Backwell, L., d'Errico, F. 2008. Early hominid bone tools from Drimolen, South Africa. *Journal of Archaeological Science* 35(11): 2880 - 2894.

Backwell, L., d'Errico, F. 2009. Assessing the function of early hominin bone tools. *Journal of Archaeological Science* 36(8): 1764 - 1773.

Bamford, M. 1999*a*. Pliocene fossil woods from an early hominid cave deposit, Sterkfontein, South Africa. *South African Journal of Science* 95: 231 - 237.

Bamford, M. 1999*b*. Palaeoenvironmental reconstruction of the Upper Pliocene Sterkfontein site from fossil wood. Paper presented at the *XVth International Congress of the International Union for Quaternary Research, The Environmental Background to Hominid Evolution in Africa,* August, Durban.

Bar Yosef, O., Eren, M.I., Yuan, J., Cohen, D.J, Li, Y. 2012. Were bamboo tools made in prehistoric Southeast Asia? An experimental view from South China. *Quaternary International* 269: 9 - 21.

Barham, L. 1987. The Bipolar Technique in Southern Africa: A Replication Experiment. *The South African Archaeological Bulletin* 42(145): 45 - 50.

Barham, L.S. 1998. Possible early pigment use in south-central Africa. *Current Anthropology* 39: 703 - 710.

Barham, L.S. 2002. Backed tools in middle Pleistocene central Africa and their evolutionary significance. *Journal of Human Evolution*. 43: 585 - 603.

Barham, L.S., Smart, P. 1996. Early date for the Middle Stone Age of central Zambia. *Journal of Human Evolution* 30: 287 - 290.

Barnett, J.R., Miller, S., Pearce, E. 2006. Colour and art: A brief history of pigments. *Optics & Laser Technology* 38: 445 - 453.

Barret, P.J. 1980. The shape of rock particles, a critical review. *Sedimentology* 27: 291 - 303.

Bassie, K. 2002. Mesoweb – Maya creator gods. Available at: http://www.mesoweb.com/features/bassie/CreatorGods/CreatorGods.pdf (accessed 7 May 2019).

Benn, D.I., Ballantyne, C.K. 1993. The description and representation of particle shape. *Earth Surface Processes and Landforms* 18: 665 - 672.

Berna, F., Goldberg, P., Horwitz, L.K., Brink, J., Holt, S., Bamford, M., Chazan, M. 2012. Microstratigraphic evidence of in situ fire in the Acheulean strata of Wonderwerk cave, northern Cape province, South Africa. *Proceeding of National Academy of Sciences* 109: 1 - 6.

Beukes, N.J., Nelson, J.P. 1995. Sea level fluctuations and basin subsidence controls on the setting of auriferous palaeoplacers in the Archaean Witwatersrand Supergroup: a genetic and sequence stratigraphic approach. Abstract: *Geocongress 95, Geological Society of South Africa:* 860 - 863.

Blumenschine, R.J., Masao, F.T., Tactikos, J.C., Ebert, J.I. 2008. Effects of distance from stone source on landscape-scale variation in Oldowan artifact assemblages in the Paleo-Olduvai Basin, Tanzania. *Journal of Archaeological Science* 35: 76 - 86.

Brain, C.K. 1981. *The Hunters or the Hunted? An Introduction to African Cave Taphonomy*. Chicago: University of Chicago Press.

Brain, C.K. (Ed.). 1993. *Swartkrans: A Cave's Chronicle of Early Man*. Pretoria: Transvaal Museum.

Brain, C.K., Sillen, A. 1988. Evidence from the Swartkrans Cave for the earliest use of fire. *Nature* 336: 464 - 466.

Brain, C.K.,Watson, V. 1992. A guide to the Swartkrans early hominid cave site. *Annals of the Transvaal Museum* 35: 343 - 365.

Brantingham, P.J. 2003. A Neutral Model of Stone Raw Material Procurement. *American Antiquity* 68(3): 487 - 509.

Brantingham, P.J., Olsen, J.W., Rech, J.A., Krivoshapkin, A.I. 2000. Raw material quality and prepared core technologies in Northeast Asia. *Journal of Archaeological Science* 27: 255 - 271.

Braun, D.R., Rogers, M.J., Harris, J.W.K., Walker, S.J. 2008a. Landscape-scale variation in hominin tool use: evidence from the Developed Oldowan. *Journal of Human Evolution* 55: 1053 - 1063.

Braun, D.R., Plummer, T., Ditchfield, P., Ferraro, J.V., Maina, D., Bishop, L.C., Potts, R. 2008b. Oldowan behaviour and raw material transport: perspectives from the Kanjera Formation. *Journal of Archaeological Science* 35: 2329 - 2345.

Braun, D.R., Plummer, T., Ferraro, J.V., Ditchfield, P., Bishop, L.C. 2009. Raw material quality and Oldowan hominin toolstone preferences: evidence from Kanjera South, Kenya. *Journal of Archaeological Science* 36: 1605 - 1614.

Braun, D.R., Levin, N.E., Stynder, D., Herries, A.I.R., Archer, W., Forrest, F., Roberts, D.L., Bishop, L.C., Matthews, T., Lehmann, S.B., Pickering, R., Fitzsimmons, K.E. 2013. Mid-pleistocene hominin occupation at Elandsfontein, western Cape, South Africa. *Quaternary Science Review* 82: 145 - 166.

Braun, D.R., Aldeias, V., Archer, W., Arrowsmith, J.R., Baraki, N., Campisano, C.J., Deino, A.L., DiMaggio, E.N., Dupont-Nivet, G., Engda, B., Feary, D.A., Garello, D.I., Kerfelew, Z., McPherron, S.P. Patterson, D.B., Reeves, J.S., Thompson, J.C. Reed, K.E. 2019. Earliest known Oldowan artifacts at >2.58 Ma from Ledi-Geraru, Ethiopia, highlight early technological diversity. *PNAS* 116(24): 11712 - 11717.

Brown, K.S., Marean, C.W., Herries, A.I.R., Jacobs, Z., Tribolo, C., Braun, D., Roberts, D.L., Meyer, M.C., Bernatchez, J. 2009. Fire as an engineering tool of early modern humans. *Science* 325: 859 - 862.

Browne, C.L., Wilson, L. 2011. Resource selection of lithic raw materials in the Middle Palaeolithic in southern France. *Journal of Human Evolution* 61: 597 - 608.

Button, A. 1973. *A regional study of the stratigraphy and development of the Transvaal basin in the eastern and northern Transvaal*. Unpublished, Ph.D. Thesis, University of Witwatersrand, Johannesburg.

Button, A. 1986. The Transvaal sub-basin of the Transvaal Sequence. In: Anhaeusser, C. R. and Maske, S (Eds), *Mineral Deposits of Southern Africa*, Geological Society of South Africa, Johannesburg, South Africa. pp. 811 - 817.

Byrne, L. 2004. Lithic tools from Arago cave, Tautavel (Pyrénées-Orientales, France): behavioural continuity or raw material determinism during the Middle Pleistocene? *Journal of Archaeological Science* 31: 351 - 364.

Byrne, F., Proffitt, T., Arroyo, A., de la Torre, I. 2015. A comparative analysis of bipolar and freehand experimental knapping products from Olduvai Gorge, Tanzania. *Quaternary International*. http://dx.doi.org/10.1016/j.quaint.2015.08.018

Cairncross, B. 2004. *Field Guide to Rocks and Minerals of Southern Africa*. Cape Town: Struik.

Carter, T., Strasser, T.F., Panagopoulou, E., Campeau, K., Mihailović, D.D. 2018. Obsidian circulation in the early Holocene Aegean: A case study from Mesolithic Damnoni (SW Crete). *Journal of Archaeological Science: Reports* 17: 173 - 183.

Catuneanu, O., Eriksson, P.G. 1999. The sequence stratigraphic concept and the Precambrian rock record: an example from the 2.7 - 2.1 Ga Transvaal Supergroup, Kaapvaal craton. *Precambrian Research* 97: 215 - 251.

Chen, J., Wu, T., Zhang, P. 1997. *Comparative study of the multi-division of the strategraphy of China-Strategraphy in North China*. Wuhan: Press of the China University of Geosciences, pp. 135 - 153 (in Chinese).

Churcher, C.S., Watson, V. 1993. Additional fossil Equidae from Swartkrans. In: Brain, C.K. (Ed.), *Swartkrans: A Cave's Chronicle of Early Man*. Pretoria: Transvaal Museum, pp. 137 - 150.

Clark, J.D. 1991. *Stone Artifact Assemblages from Swartkrans*, Transvaal, South Africa. In: Clark, J.D. (Ed*), Cultural Beginnings: Approaches to Understanding Early Hominid Life-ways in the African Savanna*. Rudolf Habelt, Bonn, Germany, pp. 137 - 158.

Clark, J.D. 1993. Stone artefact assemblages from Member 1-3, Swartkrans cave. In: Brain C.K. (Ed.), *Swartkrans: A Cave's Chronicle of Early Man*. Pretoria: Transvaal Museum, pp. 167 - 194.

Clark, J.D., Kleindienst, M.R. 2001. *The Stone Age Cultural Sequence: Terminilogy, Typology and Raw Material.* In: Clark, J.D. (Ed.), Kalambo Falls Prehistoric Site, Volume III, The Earlier Cultures: Middle and Earlier Stone Age. Cambridge University Press, Cambridge, pp. 34 - 65.

Cooper, E. 1982. The Potlatch in Ancient China: Parallels in the Sociopolitical Structure of the Ancient Chinese and the American Indians of the Northwest Coast. *History of Religions* 22(2): 103 - 128. The University of Chicago Press.

Corbey, R., Jagich, A., Vaesen, K., Collard, M. 2016. The Acheulean handaxe: more like a bird's song than a beatles' tune? *Evolutionary Anthropology* 25: 6 - 19.

Cristiani, E., Borić, D. 2016. Mesolithic harpoons from Odmut, Montenegro: Chronological, contextual, and techno-functional analyses. *Quaternary International* 423: 166 - 192.

d'Errico, F., Henshilwood, C.S. 2007. Additional evidence for bone technology in the southern African Middle Stone Age. *Journal of Human Evolution* 52: 142 - 163.

d'Errico, F., Henshilwood, C., Vanhaeren, M., van Niekerk, K. 2005. Nassarius kraussianus shell beads from Blombos Cave: evidence for symbolic behaviour in the Middle Stone Age. *Journal of Human Evolution* 48: 3 - 24.

d'Errico, F., Backwell, L.R., Wadley, L. 2012. Identifying regional variability in Middle Stone Age bone technology: The case of Sibudu Cave. *Journal of Archaeological Science* 39: 2479 - 2495.

Dankert, B.T., Hein, K.A.A. 2010. Evaluating the structural character and tectonic history of the Witwatersrand Basin. *Precambrian Research* 177: 1 - 22.

Dayet, L., Erasmus, R., Val, A., Feyfant, L., Porraz, G. 2017. Beads, pigments and early Holocene ornamental traditions at Bushman Rock Shelter, South Africa. *Journal of Archaeological Science: Reports* 13: 635 - 651.

de la Torre, I., Mora, R., Domı´nguez-Rodrigo, M., de Luque, L., Alcala´, L. 2003.The Oldowan industry of Peninj and its bearing on the reconstruction of the technological skills of Lower Pleistocene hominids. *Journal of Human Evolution* 44: 203 - 224

De Lumley, H., Li, T.Y. 2008. Le site de L'Homme de Yunxian. *CNRS Éditions.* Paris

Deacon, H.J., Deacon, J. 1999. *Human Beginnings in South Africa: Uncovering the Secrets of the Stone Age*. David Phillip, Cape Town.

Delagnes, A., Roche, H. 2005. Late Pliocene hominid knapping skills: The case of Lokalalei 2C, West Turkana, Kenya. *Journal of Human Evolution* 48: 435 - 472.

Dibble, H.L. 1991. Local Raw Material Exploitation and its Effects on Lower and Middle Paleolithic Assemblage Variability. In: Montet-White, A., Holen, S. (Eds), *Raw Material Economies Among Prehistoric Hunter-Gatherers*. University of Kansas Publications in Anthropology, 19: pp. 33 - 47.

Dibble, H. 1985. Raw-Material Variation in Levallois Flake Manufacture. *Current Anthropology* 26(3): 391 - 393.

Diez-Martín, F., Yustos, P.S., Domínguez-Rodrigo, M., Prendergast, M.E. 2011. An experimental study of bipolar and freehand knapping of Naibor Soit quartz from Olduvia Gorge (Tanzania). *American Antiquity* 76(4): 690 - 708.

Dirks, P.H.G.M., Kibii, J.M., Kuhn, B.F., Steininger, C., Churchill, S.E., Kramers, J.D., Pickering, R., Farber, D.L., Mériaux, A., Herries, A.I.R., King, G.C.P., Berger, L.R. 2010. Geological setting and age of Australopithecus sediba from southern Africa. *Science* 328: 205 - 208.

Doerr, S.H. 1999. Karst-like landforms and hydrology in quartzites of the Venezuelan shield: pseudokarst or "real" karst. *Zeitschrift fur Geomorphologie* 43: 1 - 17.

Eigeland, L. 2007. Pride and prejudice: who should care about non-flint raw material procurement in Mesolithic south-east Norway? *Lithic Technology* 32(1): 39 - 49.

Ekshtain, R, Malinsky-Buller, A., Ilani, S., Segal, I., Hovers, E. 2014. Raw material exploitation around the Middle Paleolithic site of 'Ein Qashish. *Quaternary International* 331: 248 - 266.

Eren, M.I., Lycett, S.J., Roos, C.I., Sampson, C.G. 2011. Toolstone constraints on knapping skill: Levallois reduction with two different raw materials. *Journal of Archaeological Science* 38: 2731 - 2739.

Eren, M.I., Roos, C.I., Story, B.A., von Cramon-Taubadel, N., Lycett, S.J. 2014. The role of raw material differences in stone tool shape variation: an experimental assessment. *Journal of Archaeological Science* 49: 472 - 487.

Eriksson, K.A. 1977. Tidal flats and subtidal sedimentation in the 2250 M.Y. Malmani dolomite, Transvaal, South Africa. *Sedimentary Geology* 18: 223 - 244.

Eriksson, K.A., Turner, B.R., Vos, R.G. 1981. Evidence of tidal processes from the lower part of the Witwatersrand Supergroup, South Africa. *Sedimentary Geology* 29: 309 - 325.

Eriksson, P. G., Clendenin, C.W. 1990. A review of the Transvaal Sequence, South Africa. *Journal of African Earth Sciences* 10: 101 - 116.

Eriksson, P.G., Schweitzer, J.K., Bosch, P.J.A., Schereiber, U.M., Van Deventer, J.L., Hatton, C.J. 1993. The Transvaal Sequence: an overview. *Journal of African Earth Sciences* 16: 25 - 51.

Eriksson, P.G., Altermann, W., Catuneanu, O., van der Merwe, R., Bumby, A.J. 2001. Major influences on the evolution of the 2.67-2.1 Ga Transvaal basin, Kaapvaal craton. *Sedimentary Geology* 141: 205 - 231.

Eriksson, P.G., Altermann, W., Hartzer, F.J. 2006. The Transvaal Supergroup and its Precursors. In: Johnson, M.R., Anhaeusser, C.R., Thomas, R.J. (Eds), *The Geology of South Africa.* Geological Society of South Africa, Johannesburg / Council for Geosciences, Pretoria, pp. 237 - 260.

Farndon, J. 2006. *The Practical Encyclopaedia of Rocks and Minerals*. Lorenz Books, London.

Feng, X.B. 2008.Technological characterisation of China and Europe lower Paleolithic industry from 1 Ma to 400,000 years: similarity and difference between the Yunxian Hominid culture and European Acheulean. *L'anthropologie* 112: 423 - 447.

Field, A.S. 1999. *An Analytical and Comparative Study of the Earlier Stone Age Archaeology of the Sterkfontein Valley*. M.Sc. Dissertation, University of Witwatersrand, Johannesburg.

Flenniken, J.J., White, J.P. 1985. Australian flaked stone tools: a technological perspective. *Records of the Australian Museum* 36(3): 131 - 151.

Gallotti, R., Raynal, J-P., Geraads, D., Mussi, M. 2014. Garba XIII (Melka Kunture, Upper Awash, Ethiopia): A new Acheulean site of the late Lower Pleistocene. *Quaternary International* 343: 17 - 27.

Gao, X. 2012. Characteristics and significance of Paleolithic handaxes from China. *Acta Anthropologica Sinica* 31(2): 97 - 112 (Chinese, with English Abstract).

Gendron, F., Calligaro, T., Richardin, P., Duverger, C., Letouzé, A., Garcia, F., Cuynet, F., Marigo, S., Sakowicz, K., Mancina, P. 2019. The evolution of obsidian procurement in ancient Oaxaca, Mexico: New data from the Sistema 7 Venado architectural complex, Monte Albán. *Journal of Archaeological Science: Reports* 23: 583 - 591.

Gibbon, R.J., Pickering, T.R, Sutton, M.B., Heaton., J.L., Kuman, K., Clarke, R.J., Brain, C.K., Granger, D.E. 2014. Cosmogenic nuclide burial dating of hominin-bearing Pleistocene cave deposits at Swartkrans, South Africa. *Quaternary Geochronology* 24: 10 - 15.

Goldman-Neuman, T., Hovers, E. 2012. Raw material selectivity in Late Pliocene Oldowan sites in the Makaamitalu Basin, Hadar, Ethiopia. *Journal of Human Evolution* 62(3): 353 - 366.

Granger, D.E., Gibbon, R.J., Kuman, K., Clarke, R.J., Bruxelles, L., Caffee, M.W. 2015. New cosmogenic burial ages for Sterkfontein member 2 Australopithecus and member 5 Oldowan. *Nature* 522: 85 - 88.

Groucutt, H.S., Scerri, E.M.L., Amor, K., Shipton, C., Jennings, R.P., Parton, A., Clark-Balzan, L., Abdullah Alsharekh, A., Petraglia, M.D. 2017. Middle Palaeolithic raw material procurement and early stage reduction at Jubbah, Saudi Arabia. *Archaeological Research in Asia* 9: 44 - 62.

Gurtov, A.N., Eren, M.I. 2014. Lower Paleolithic bipolar reduction and hominin selection of quartz at Olduvai Gorge, Tanzania: What's the connection? *Quaternary International* 322 - 323: 285 - 291.

Harkin, E. 2001. Potlatch in Anthropology. In: Smelser, N.J., Baltes, P.B. (Eds), *International Encyclopedia of the Social and Behavioral Sciences*, vol 17, Oxford: Pergamon Press, pp. 11885 - 11889.

Harmand, S. 2009. Variability in raw material selection at the Late Pliocene sites of Lokalalei, West Turkana, Kenya. In: Hovers, E., Braun, D.R. (Eds.), *Interdisciplinary Approaches to the Oldowan*. Springer, Dordrecht, Netherlands, pp. 85 - 98.

Harmand, S., Lewis, J.E, Feibel, G.S., Lepre, C.J., Prat, S., Lenoble, A., Boës, X., Quinn, R.L., Brenet, M., Arroyo, A., Taylor, N., Clément, S., Daver, G., Brugal, J-P., Leakey, L., Mortlock, R.A., Wright, J.D., Lokorodi, S., Kirwa, C., Kent, D.V., Roche, H. 2015. 3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya. *Nature* 521: 310 - 315.

Hay, R.L. 1976. *Geology of the Olduvai Gorge: A Study of Sedimentation in a Semiarid Basin*. University of California Press, Berkeley, California.

Henshilwood, C.S., d'Errico, F., Vanhaeren, M., Van Niekerk, K., Jacobs, Z. 2004. Middle Stone Age shell beads from South Africa. *Science* 304: 404.

Hoinkes, G., Hauzenberger, C.A., Schmid, R. 2005. Metamorphic rocks: classification, nomenclature and formation. In: Selley, R.C., Cocks, L.R.M., Plimer, I.R. (Eds.), *Encyclopedia of Geology*. Elsevier Academic Press.

Hull, S., Fayek, M., Mathien, F.J., Roberts, H. 2014. Turquoise trade of the Ancestral Puebloan: Chaco and beyond. *Journal of Archaeological Science* 45: 187 - 195.

Illenberger, W.K. 1991. Pebble shape (and size). *Journal of Sedimentary Petrology* 61(5): 756 - 767.

Isaac, G.L., Harris, J.W.K., Kroll, E. 1997. The stone artifact assemblages: a comparative study. In: Isaac, G., Isaac, B. (Eds.), *Koobi Fora Research Project, Volume 5: Plio-Pleistocene Archaeology*. Clarendon Press, Oxford, pp. 262 - 299.

Klein, R.G. 2000. The Earlier Stone Age of southern Africa. *Southern African Archaeological Bulletin*. 55: 107 - 122.

Kleindienst, M.R. 1962. *Component of the East African Acheulian Assemblage: An Analytic Approach.* In: Mortelmans, G., Nenquin, J. (Eds.), Actes du IV Congrès Panafricain de Préhistoire et de ÍEtude du Quaternaire, Leopoldville. 1959. Belgie Annalen, Musée Royal de ÍAfrique Centrale, Tervuren, pp. 81 - 108.

Krauskopf, K.B. 1956. Dissolution and precipitation of silica at low temperatures. *Geochimica et Cosmochimica Acta* 10: 1 - 26.

Kuman, K. 1994. The archaeology of Sterkfontein- past and present. *Journal of Human Evolution* 27: 471 - 495.

Kuman, K. 1996. The Oldowan industry from Sterkfontein: raw materials and core forms. In: Pwiti, G. & Soper, R. (Eds), *Aspects of African Archaeology: Papers from the 10th Congress of the Panafrican Association for Prehistory and Related Studies*. Harare: University of Zimbabwe Press, pp. 139 - 146.

Kuman, K. 1998. The earliest South African industries. In M. Petraglia & R. Korisettar (eds): *Early Human Behavior in Global Context: The Rise and Diversity of the Lower Palaeolithic Record*. London: Routledge Press, pp. 151 - 186.

Kuman, K. 2003. Site formation in the early South African Stone Age sites and its influence on the archaeological record. *South African Journal of Science* 99: 251 - 254.

Kuman, K. 2007. The earlier stone age in Southern Africa: site context and the influence of cave studies. In: Pickering, T., Schick, K., Toth, N. (Eds.), *Breathing Life into Fossils. Taphonomic Studies in Honour of C.K. (Bob) Brain*. Stone Age Institute Press, Bloomington, Indiana, pp. 181 - 198.

Kuman, K. 2014. The Acheulean industrial complex. In: Smith, C. (Ed.), *Encyclopaedia of Global Archaeology*. Springer, New York, pp. 7 - 18.

Kuman, K., Clarke, R.J. 2000. Stratigraphy, artefact industries and hominid associations for Sterkfontein, Member 5. *Journal of Human Evolution* 38: 827 - 847.

Kuman, K. & Field, A.S. 2009. The Oldowan industry from Sterkfontein caves, South Africa. In: Schick, K & Toth, N. (Eds), *The Cutting Edge: New Approaches to the Archaeology of Human Origins*. Gosport, Indiana: Stone Age Institute Press, pp. 151 - 169.

Kuman, K., Li, C., Li, H. 2014. Large cutting tools in the Danjiangkou Reservoir Region, central China. *Journal of Human Evolution* 76: 129 - 153.

Kuman, K., Gibbon, R.J. 2017. The Rietputs 15 site and Early Acheulean in South Africa. *Quaternary International* in press.

Kuman, K., Sutton, M.B., Pickering, T.R., Heaton, J.L. 2018. The Oldowan industry from Swartkrans Cave, South Africa. *Journal of Human Evolution* 123: 52 - 69.

Kunitake, S. 2016. Settlement behavior in the Kanto Plain during the Japanese Paleolithic based on lithic raw material procurement and consumption. *Quaternary International* 425: 158 - 172.

Lamotte, A., Chanson, J-M., Willemann, G., Galtier, F. 2017. Handaxes and leafpoints of eastern France: Spatial patterns and role of the raw materials. *Quaternary International* 428: 79 - 90.

Leng, J. 2001. Early Paleolithic Technology in Eastern and Southern Asia. *British Archaeological Reports International Series 924*. Archaeopress, Oxford.

Leng, J., Shannon, C.L. 2000. Rethinking Early Paleolithic typologies in China and India. *Journal of East Asian Archaeology* 2: 1 - 2.

Lengyel, G. 2015. Lithic raw material procurement at Bodrogkeresztúre-Henye Gravettian site, northeast Hungary. *Quaternary International* 359 - 360: 292 - 303.

Li, T.Y., Etler, D.A. 1992. New Middle Pleistocene hominid crania from Yunxian in China. *Nature* 357: 404 - 407.

Li, H., Li, C.R., Kuman, K. 2013. A preliminary report on the excavation of the Guochachang II Paleolithic site in the Danjiangkou Reservior Region, Hubeo province, China. *Acta Anthropologica Sinica* 32(2): 144 - 155. (Chinese, with English Abstract).

Li, H., Li, C., Kuman, K., Cheng, J., Yao, H, Li, Z. 2014a. The Middle Pleistocene handaxe site of Shuangshu in the Danjiangkou Reservoir Region, central China. *Journal of Archaeological Science* 52: 391 - 409.

Li, H., Li, C., Kuman, K. 2014b. Rethinking the "Acheulean" in East Asia: evidence from recent investigations in the Danjiangkou Reservoir region, central China. *Quaternary International* 347: 163 - 175.

Li H, Kuman K, Li CR. 2015. Quantifying the reduction intensity of handaxes with 3D technology: a case study of handaxes in the Danjiangkou Reservoir Region, central China. *PLoS One* 10 (9): e0135613.

Li, F., Kuhn, S.L., Chen, F.-Y., Gao, X. 2016. Raw material economies and mobility patterns in the Late Paleolithic at Shuidonggou locality 2, north China. *Journal of Anthropological Archaeology* 43: 83 - 93.

Li, H., Li, C., Sherwood, N.L., Kuman, K. 2017a. Experimental flaking in the Danjiangkou Reservoir Region (central China): A rare case of bipolar blanks in the Acheulean. *Journal of Archaeological Science*: Reports 13: 26 - 35.

Li, H., Kuman, K., Lotter, M.G., Leader, G.M., Gibbon, R.J. 2017b. The Victoria West: earliest prepared core technology in the Acheulean at Canteen Kopje and implications for the cognitive evolution of early hominids. *Royal Society of Open Science* 4(6): 170288.

Lin, S. 1994. Restudy of the nine hand-axe specimens and the applicability of Movius theory. *Acta Anthropologica Sinica* 13(3): 189 - 208 (Chinese with English Abstract).

Lin, S.C., Peng, F., Zwyns, N., Guo, J., Wang, H., Gao, X. 2019. Detecting patterns of local raw material utilization among informal lithic assemblages at the late Paleolithic site of Shuidonggou Locality 2 (China). *Archaeological Research in Asia* 17: 137 - 148.

Livingston, R., O'Connor, A., LaManna, J., Chen-Mayer, H., Turkoglu, D. 2018. Investigation of a simulated Chinese jade and bronze dagger-axe by neutron

radiography and prompt gamma activation analysis. *Journal of Archaeological Science: Reports* 21: 99 - 106.

Loendorf, C., Blikre, L., Bryce, W.D., Oliver, T.J., Denoyer. A., Wermers, G. 2018. Raw material impact strength and flaked stone projectile point performance. *Journal of Archaeological Science* 90: 50 - 61.

Ludwig, B.V., Harris, J.W.K. 1998. Towards a technological reassessment of East African Plio-Pleistocene lithic assemblages. In: Petraglia, M., Korisetter, R. (Eds.), Early *Human Behavior in the Global Context: The Rise and Diversity of the Lower Paleolithic Period*. Routledge, New York, pp. 84 - 107.

Lui, Y., Hou, Y.M., Ao, H. 2013. Analysis of lithic technology of Lower Pleistocene sites and environmental information in the Nihewan Basin, North China. *Quaternary International* 295: 215 - 222.

Luncz, L.V., Sirianni, G., Mundry, R., Boesch, C. 2018. Costly culture: differences in nut-cracking efficiency between wild chimpanzee groups. *Animal Behaviour* 137: 63 - 73.

Luyt, C.J., Lee-Thorp, J.A. 2003. Carbon isotope ratios of Sterkfontein fossils indicate a marked shift to open environments C. 1.7 Myr ago. *South African Journal of Science* 99: 271 - 273.

Lycett, S.J., Bae, C.J. 2010. The Movius Line controversy: the state of the debate. *World Archaeology* 42(4): 521 - 544.

Lycett, S.J., von Cramon-Taubadel, N., Gowlett, J.A.J. 2010. A comparative 3D geometric morphometric analysis of Victoria West cores: implications for the origins of Levallois technology. *Journal of Archaeological Science* 37: 1110 - 1117.

Manninen, M.A. 2016. The effect of raw material properties on flake and flake-tool dimensions: A comparison between quartz and chert. *Quaternary International* 424: 24 - 31.

Margaris, A.V. 2014. Reconsidering raw material selection: skeletal technologies and design for durability in subarctic Alaska. *Journal of Archaeological Method and Theory* 21(3): 669 - 695.

Marshak, S. 2013. *Essentials of Geology, 4th Ed*. W.W. Norton Company, New York.

Martini, J.E.J. 1979. Karst in Black Reef quartzite near Kaapsehoop, eastern Transvaal. *Annals of the South African Geological Survey* 13: 115 - 128.

Mattson, H.V. 2016. Ornaments as socially valuable objects: Jewelry and identity in the Chaco and post-Chaco worlds. *Journal of Anthropological Archaeology* 42: 122 - 139.

McBrearty, S. 2001. The Middle Pleistocene of east Africa. In: Barham, L., Robson- Brown, K. (Eds.), *Human Roots: Africa and Asia in the Middle Pleistocene*. Western Academic and Specialist Press, Bristol, pp. 81 - 98.

McBrearty, S., Brooks, A.S. 2000. The revolution that wasn't: a new interpretation of the origin of modern human behaviour. *Journal of Human Evolution* 39: 453 - 563.

McCarthy, T.S. 2006. The Witwatersrand Supergroup. In: Johnson, M.R., Anhaeusser, C.R., Thomas, R.J. (Eds), *The Geology of South Africa.* Geological Society of South Africa, Johannesburg / Council for Geosciences, Pretoria, pp. 155 - 186.

McHenry, L.J., de la Torre, I. 2018. Hominin raw material procurement in the Oldowan-Acheulean transition at Olduvai Gorge. *Journal of Human Evolution* 120: 378 - 401.

McNabb, J., Binyon, F., Hazelwood, L. 2004. The large cutting tools from the South African Acheulean and the question of social traditions. *Current Anthropology* 45(5): 653 - 676.

McNabb, J., Cole, J. 2015. The mirror cracked: Symmetry and refinement in the Acheulean handaxe. *Journal of Archaeological Science: Reports* 3:100 - 111.

McNabb, J., Kuman, K. 2015. Experimental stone tool replication at the Early Stone Age site of Sterkfontein, Gauteng, South Africa. *Journal of Archaeological Science: Reports* 4: 44 - 53.

Méndez-Quintas, E., Demuro, M., Arnold, L.J., Duval, M., Pérez-González, A., Santonja, M. 2019. Insights into the late stages of the Acheulean technocomplex of Western Iberia from the Arbo site (Galicia, Spain). *Journal of Archaeological Science: Reports* 27: 101934.

Merrick, H.V., Brown, F.H. 1984. Obsidian sources and patterns of source utilization in Kenya and northern Tanzania: some initial findings. *The African Archaeological Review* 2: 129 - 152

Miller, J.M., Willoughby, P.R. 2014. Radiometrically dated ostrich eggshell beads from the Middle and Later Stone Age of Magubike Rockshelter, southern Tanzania. *Journal of Human Evolution* 74: 118 - 122.

Moník, M., Hadraba, H. 2016. Mechanical characterization of raw material quality and its implication for Early Upper Palaeolithic Moravia. *Quaternary International* 425: 425 - 436.

Movius, H.L. 1948. The Lower Palaeolithic cultures of southern and eastern Asia. *Transactions of the American Philosophical Society* 38(4): 329 - 420.

Movius, H.L. 1969. Lower Palaeolithic archaeology in southern Asia and the far East. In: Howells, W.W. (Ed.), *Early Man in the Far East. Studies in Physical Anthropology No.1*. Humanities Press, New York, pp. 17 - 82.

Moyo, S., Mphuthi, D., Cukrowska, E., Henshilwood, C.S., van Niekerk, K., Chimuka, L. 2016. Blombos Cave: Middle Stone Age ochre differentiation through FTIR, ICP OES, ED XRF and XRD. *Quaternary International* 404: 20 - 29.

Nash, D.J., Coulson, S., Staurset, S., Ullyott, J.S., Babutsi, M., Hopkinson, L., Smith, M.P. 2013. Provenancing of silcrete raw materials indicates long-distance transport to

Tsodilo Hills, Botswana, during the Middle Stone Age. *Journal of Human Evolution* 64: 280 - 288.

Nash, D.J., Coulson, S., Staurset, S., Ullyott,J.S., Babutsi, M., Smith, M.P. 2016. Going the distance: Mapping mobility in the Kalahari Desert during the Middle Stone Age through multi-site geochemical provenancing of silcrete artefacts. *Journal of Human Evolution* 96: 113 - 133.

Negash,A., Shackley, M.S., Alene, M. 2006. Source provenance of obsidian artifacts from the Early Stone Age (ESA) site of Melka Konture, Ethiopia. *Journal of Archaeological Science* 33: 1647 - 1650.

Pagès-Camagna, S., Raue, D. 2016. Coloured materials used in Elephantine: Evolution and continuity from the Old Kingdom to the Roman Period Sandrine. *Journal of Archaeological Science: Reports* 7: 662 - 667.

Parcak, S. 2019. *Archaeology from Space: How the Future Shapes Our Past*. Henry Holt and Company, pp. 165-184.

Parcak, S., Gathings, D., Childs, C., Mumford, G., Cline, E. 2016. Satellite evidence of archaeological site looting in Egypt: 2002–2013. *Antiquity* 90(349): 188 - 205.

Partridge, T.C. 1978. Re-appraisal of lithostratigraphy of Sterkfontein hominid site. *Nature* 275: 282 - 287.

Partridge, T.C., Granger, D.E., Caffee, M.W., Clarke, R.J. 2003. Lower Pliocene hominid remains from Sterkfontein. *Science* 300: 607 - 612.

Pei, S., Guan, Y., Goa, W. 2008. A preliminary report on the excavation of the Pengjiahe Paleolithic site in the Danjiangkou Reservoir Region. *Acta Anthropologica Sinica* 27 (2): 95 - 110. (Chinese with English Abstract).

Pellant, C. 1992. *Rocks and Minerals*. Dorling Kinderskey, London.

Peters, C.R., Blumenschine, R.J. 1995. Landscape perspectives on possible land use patterns for Early Pleistocene hominids in the Olduvai Basin, Tanzania. *Journal of Human Evolution* 29: 321 - 362.

Phillips, G.N., Law, J.D.M, Myers, R.E. 1990. The role of fluids in the evolution of the Witwatersrand Basin. *South African Journal of Geology* 93(1): 54 - 69.

Pickering, T.R. 2002. Reconsideration of criteria for differentiating faunal assemblages accumulated by hyenas and hominids. *International Journal of Osteoarchaeology* 12: 127 - 141.

Pickering, T. R., Domınguez-Rodrigo, M., Egeland, C. P. & Brain, C. K. 2004. New data and ideas on the foraging behaviour of Early Stone Age hominids at Swartkrans Cave, South Africa. *South African Journal of Science* 100: 215 - 219.

Pickering, T.R., Egeland, C.P., Domínguez-Rodrigo, M., Brain, C.K., Schnell, A.G. 2008. Testing the "shift in the balance of power" hypothesis at Swartkrans, South Africa: Hominid cave use and subsistence behavior in the Early Pleistocene. *Journal of Anthropological Archaeology* 27: 30 - 45.

Pickering, R., Kramers, J.D., Hancox, P.J., de Ruiter, D., Woodhead, J. 2011. Contemporary flowstone development links early hominin bearing cave deposits in South Africa. *Earth and Planetary Science Letters* 306: 23 - 32.

Pierce. D.E. 2017. Finding class in the glass: Obsidian source as a costly signal. *Journal of Anthropological Archaeology* 48: 217 - 232.

Plummer, T. 2004. Flaked stones and old bones: biological and cultural evolution at the dawn of technology. *American Journal of Physical Anthropology* 39: 118 - 164.

Potts, R. 1988. *Early Hominid Activities at Olduvai*. Aldine and Gruyter, New York.

Potts, R. 1991. Why the Oldowan? Plio-Pleistocene Toolmaking and the Transport of Resources. *Journal of Anthropological Research* 47(2): 153 - 176.

Prassack, K.A. 2014. Landscape distribution and ecology of Plio-Pleistocene avifaunal communities from Lowermost Bed II, Olduvai Gorge, Tanzania. *Journal of Human Evolution* 70: 1 - 15.

Proffitt, T., Haslam, M., Mercader, J.F., Boesch, C., Luncz, LV. 2018. Revisiting Panda 100, the first archaeological chimpanzee nut-cracking site. *Journal of Human Evolution* 124: 117 - 139.

Qiu, Z.L., Xu, C.H., Zhang, W.H., Wang, R.L., Wang, J.Z., Zhao, C.F. 1982. A human fossil tooth and fossil mammals from Nanzhao, Henan. *Acta Anthropologica Sinica* 1 (2): 109 - 118 (Chinese, with English Abstract).

Re, A., Angelici, D., Lo Giudice, A., Corsi, J., Allegretti, S., Biondi, A.F., Gariani. G., Calusi, S., Gelli, N., Giuntini, L., Massi, M., Taccetti, F., La Torre, L., Rigato, V., Pratesi G. 2015. Ion Beam Analysis for the provenance attribution of lapis lazuli used in glyptic art: The case of the ‘‘Collezione Medicea’’ *Nuclear Instruments and Methods in Physics Research B* 348: 278 - 284.

Reimold, W.U. 2006. Impact Structures in South Africa. In: Johnson, M.R., Anhaeusser, C.R., Thomas, R.J. (Eds), *The Geology of South Africa.* Geological Society of South Africa, Johannesburg / Council for Geosciences, Pretoria, pp. 629 - 649.

Reynolds, S.C., Clarke, R.J., Kuman, K.A. 2007. The view from the Lincoln Cave: mid- to late Pleistocene fossil deposits from Sterkfontein hominid site, South Africa. *Journal of Human Evolution* 53: 260 - 271.

Robb, L.J., Meyer, F.M. 1995. The Witwatersrand Basin, South Africa: geological framework and mineralisation processes. *Ore Geology Reviews* 10: 67 - 94.

Roe, D.A. 1994. A metrical analysis of selected sets of handaxes and cleavers from Olduvia Gorge. In: Leaky, M.D., Roe, D.A. (Eds.), *Olduvia Gorge, Volume 5. Excavations in Beds III, IV and the Masek Beds, 1968 - 1971*. Cambridge University Press, Cambridge, pp. 146 - 234.

Roering, C., and Smit, C.A. 1987. Bedding-parallel shear, thrusting and quartz vein formation in Witwatersrand quartzites. *Journal of Structural Geology* 9(4): 419 - 427.

Rosen, L.V. 1990. *Lapis Lazuli in Archaeological Contexts*. Paul Astroms Forlag, Jonsered, Sweden.

Schick, K.D. 1994. The Movius Line reconsidered. In: Corruccini, R.S., Ciochon, R.L. (Eds.*), Integrative Paths to the Past: Paleoanthropological Advances,* in Honor of F. Clark Howell. Prentice Hall, Englewood Cliffs, pp. 569 - 596.

Schick K, Toth N. 1994. Early Stone Age Technology in Africa: a review and case study into the nature and function of spheroids and subspheroids. In: Coruccini, R., Ciochon, R. (Eds), *Integrative Paths to the Past: Palaeoanthropological Advances in Honor of F. Clark Howell*. Englewood Cliffs: Prentice-Hall, pp. 429 - 49.

Schmidt, P., Porraz, G., Slodczyk, A., Bellot-Gurlet, L., Archer, W., Miller, C.E. 2013. Heat treatment in the South African Middle Stone Age: temperature induced transformations of silcrete and their technological implications. *Journal of Archaeological Science* 40: 3519 - 3531.

Schmidt, P., Porraz, G., Bellot-Gurlet, L., February, E., Ligouis, B., Paris, C., Texier, P-J., Parkington, J.E., Miller, C.E., Nickel, K.G., Conard, N.J. 2015. A previously undescribed organic residue sheds light on heat treatment in the Middle Stone Age. *Journal of Human Evolution* 85: 22 - 34.

Schmidt, P., Högberg, A. 2018. Heat treatment in the Still Bay - A case study on Hollow Rock Shelter, South Africa. *Journal of Archaeological Science: Reports* 21: 712 - 720.

Semaw, S. 2000. The world's oldest stone artefacts from Gona, Ethiopia: their implications for understanding stone technology and patterns of human evolution between 2·6 - 1·5 million years ago. *Journal of Archaeological Science* 27: 1197 - 1214.

Semaw, S., Rogers, M.J., Quade, J., Renne, P.R., Butler, R.F., Dominguez-Rodrigo, M., Stout, D., Hart, W.S., Pickering, T., Simpson, S.W. 2003. 2.6-Million-year-old stone tools and associated bones from OGS-6 and OGS-7, Gona, Afar, Ethiopia. *Journal of Human Evolution* 45: 169 - 177.

Sharon. G. 2008. The impact of raw material on Acheulian large flake production. *Journal of Archaeological Science* 35: 1329 - 1344.

Shen, Y.C. 1956. Landscape and its development history of Hanjiang River Valley. *Acta Geographica Sinica* 22(4): 295 - 321 (Chinese, with English abstract).

Sherwood, N.L. 2013. *Lithic Raw Material Procurement Through Time at Swartkrans: Earlier to Middle Stone Age*. Unpublished M.Sc. Thesis, University of the Witwatersrand, Johannesburg.

Sherwood, N.L., Li, H., Kuman, K., Li, C. 2018. Lithic raw material quality of Middle Pleistocene artefacts from the Han River, Danjiangkou Reservoir Region, central China. *Quaternary International* 480: *141 - 151*.

Siever, R. 1962. Silica solubility, 0-200°C and the diagenesis of siliceous sediments. *Journal of Geology* 70: 127 - 150.

Sikes, N.E. 1994. Early hominid habitat preferences in East Africa: paleosol carbon isotopic evidence. *Journal of Human Evolution* 27: 25 - 45.

Singer, R., & Wymer, J. 1982. *The Middle Stone Age at Klasies River Mouth in South Africa*. Chicago University Press, Chicago.

Sleep, N.H., Hessler, A.M. 2006. Weathering of quartz as an Archean climatic indicator. *Earth and Planetary Science Letters* 241: 594 - 602.

So. J.F. in press. Connecting friend and foe: Western Zhou personal regalia in jade and colored stones. *Archaeological Research in Asia.*

Stammers, R.C., Caruana, M.V., Andy I.R. Herries, A.I.R. 2018. The first bone tools from Kromdraai and stone tools from Drimolen, and the place of bone tools in the South African Earlier Stone Age. *Quaternary International* 495: 87 - 101.

Stanistreet, I.G., McCarthy, T.S., Charlesworth, E.G., Myers, R.E, Armstrong, R.A. 1986. Pre-Transvaal wrench tectonics along the northern margin of the Witwatersrand Basin, South Africa. *Tectonophysics* 131: 53 - 74.

Stanistreet, I.G., McCarthy, T.S. 1991. Changing tectono-sedimentary scenarios relevant to the development of the late Archaean Witwatersrand Basin. *Journal of African Earth Sciences* 13(1): 65 - 81.

Stemp, W.J., Braswell, G.E. Helmkec, C.G.B., Awe, J.J. 2018. An ancient Maya ritual cache at Pook's Hill, Belize: Technological and functional analyses of the obsidian blades. *Journal of Archaeological Science: Reports* 18: 889 - 901.

Stemp, W.J., Peuramaki-Brown, M., Awe, J.J. 2019. Ritual economy and ancient Maya bloodletting: Obsidian blades from Actun Uayazba Kab (Handprint Cave), Belize. *Journal of Anthropological Archaeology* 53: 304 - 324.

Sternke.F. 2007. The German quartzite Palaeolithic: an exploration of late Middle Pleistocene hominid behaviour in relation to the utilization of non-flint raw material. *Lithic Technology* 32(1): 115 - 130.

Stout, D., Quade, J., Semaw, S., Rogers, M.J., Levin, N.E. 2005. Raw material selectivity of the earliest stone toolmakers at Gona, Afar, Ethiopia. *Journal of Human Evolution* 48: 365 - 380.

Stout, D., Semaw, S. 2006. Knapping skill of the earliest stone toolmakers: insights from the study of modern human novices. In: Toth, N., Schick, K. (Eds.), *The Oldowan: Case Studies into the Earliest Stone Age*. Stone Age Institute Press, Gosport, IN, pp. 307 - 320.

Stout, D., Semaw, S., Rogers, M.J., Cauche, D. 2010. Technological variation in the earliest Oldowan from Gona, Afar, Ethiopia. *Journal of Human Evolution* 58: 474 - 491.

Sutton, E.A. 2014. Digging stick weights and doughnut stones: an analysis of perforated stones from the Santa Barbara Channel Region. *Journal of California and Great Basin Anthropology* 34(1): 17 - 42.

Sutton, M. B. 2012. *The archaeology of Swartkrans Cave, Gauteng, South Africa: new excavations of Members 1 and 4*. Unpublished Ph.D. Thesis, University of the Witwatersrand, Johannesburg.

Sutton, M.B., Pickering, T.R., Pickering, R., Brain, C.K., Clarke, R.J., Heaton, J.L. and Kuman, K. 2009. Newly discovered fossil- and artifact-bearing deposits, uranium-series ages, and Plio-Pleistocene hominids at Swartkrans Cave, South Africa. *Journal of Human Evolution* 57: 688 - 696.

Tallavaara, M., Manninen, M.A., Hertell, E., Rankama, T. 2010. How flakes shatter: a critical evaluation of quartz fracture analysis. *Journal of Archaeological Science* 37: 2442 - 2448.

Trewin, N.H., Fayers, S.R. 2005. Chert. In: Selley, R.C., Cocks, L.R.M., Plimer, I.R. (Eds), *Encyclopedia of Geology*. Elsevier Academic Press.

Tricart, J. 1972. *The Landforms of the Humid Tropics, Forests and Savannas*. Longman. London.

Torres, J. 1998. Lithic procurement in the eastern Mojave Desert and the use of the Juan obsidian clast source. *Lithic Technology* 23(2): 85 - 89.

Toth, N. 1985. The Oldowan reassessed: A close look at early stone artefacts. *Journal of Archaeological Science* 12: 101 - 120.

Toth, N., Schick, K. 2018. An overview of the cognitive implications of the Oldowan Industrial Complex. *Azania: Archaeological Research in Africa* 53(1): 3 - 39.

Vanhaeren, M., d'Errico, F., van Niekerk, K.L., Henshilwood, C.S., Erasmus, R.M. 2013. Thinking strings: Additional evidence for personal ornament use in the Middle Stone Age at Blombos Cave, South Africa. *Journal of Human Evolution* 64: 500 - 517.

Vialet A., Guipert G., He Jianing, Feng Xiaobo, Lu Zune, Wang Youping, Li Tianyuan, de Lumley M-A., de Lumley H. 2010. Homo erectus from the Yunxian and Nankin Chinese sites: Anthropological insights using 3D virtual imaging techniques. C.R. *Palevol* 9: 331 - 339.

Villa, P., Soriano, S., Teyssandier, N., Wurz, S. 2010. The Howiesons Poort and MSA III at Klasies River main site, Cave 1A. *Journal of Archaeological Science* 37: 630 - 655.

Vrba, E. S. 1985. Early hominids in southern Africa: updated observations on chronological and ecological background. In (Tobias, P. V., Ed.) *Hominid Evolution. Past, Present and Future*, pp. 195 - 200. Alan R. Liss, New York.

Wadley, L. 2005. Putting ochre to the test: replication studies of adhesives that may have been used for hafting tools in the Middle Stone Age. *Journal of Human Evolution* 49: 587 - 601.

Wadley. L. 2010. Cemented ash as a receptacle or work surface for ochre powder production at Sibudu, South Africa, 58,000 years ago. *Journal of Archaeological Science* 37: 2397 - 2406.

Wadley, L., Kempson, H. 2011. A review of rock studies for archaeologists, and an analysis of dolerite and hornfels from the Sibudu area, KwaZulu-Natal. *Southern African Humanities* 23: 87 - 107.

Wadley, L., Prinsloo, L.C. 2014. Experimental heat treatment of silcrete implies analogical reasoning in the Middle Stone Age. *Journal of Human Evolution* 70: 49 - 60.

Walter, M.R., Golubic, S., Preiss, W.V. 1974. Recent stromatolites from hydromagnesite and aragonite depositing lakes near the Coorong Lagoon, South Australia. *Journal of Sedimentary Petrology* 43: 1021 - 1030.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. *The Journal of Geology* 30(5): 377 - 392.

Werner, J.J., Miller, J.M. 2018. Distinguishing stone age drilling techniques on ostrich eggshell beads: An experimental approach. *Journal of Archaeological Science: Reports* 22: 108 - 114.

Wilkins, J. 2017. Middle Pleistocene lithic raw material foraging strategies at Kathu Pan 1, Northern Cape, South Africa. *Journal of Archaeological Science:* Reports 11: 169 - 188.

Will, M., Mackay, A. 2017.What factors govern the procurement and use of silcrete during the Stone Age of South Africa? *Journal of Archaeological Science: Reports* 15: 630 - 645.

Wilson, L. 2007. Understanding prehistoric lithic raw material selection: application of a gravity model. *Journal of Archaeological Method and Theory* 14: 388 - 411.

Wilson, L., Browne, C.L. 2014. Change in raw material selection and subsistence behaviour through time at a Middle Palaeolithic site in southern France. *Journal of Human Evolution* 75: 28 - 39.

Winter, H. de la R., Brink, M.C. 1991. Chrono-stratigraphy subdivision of the Witwatersrand Basin based on Western Transvaal composite columns. *South African Journal of Geology* 94: 191 - 203.

Wray, R.A.L. 1997. A global review of solutional weathering forms on quartz sandstones. *Earth-Science Reviews* 42: 137 - 160.

Wu. R.K., Dong, X.R. 1980. Human fossil teeth discovery in Longgudong cave, Meipu, Yunxian, Hubei. *Vertebrata PalAsiatica* 2: 142 - 179 (Chinese, with English Abstract).

Wu, R.K., Wu, X.Z. 1982. Human fossil teeth collected from Xichuan, Henan. *Vertebrata PalAsiatica* 20(1): 1 - 9 (Chinese, with English Abstract).

Xie, L., Gallo, T., Macdonald, D. 2019. Microwear analysis on experimental ground stone earth-working implements and its implication for investigating ancient agricultural practices. *Journal of Archaeological Science: Reports* 25: 351 - 369.

Yang, S.X., Huang, W.W., Hou, Y.M., Yuan, B.Y. 2014. Is the Dingcun lithic assemblage a "chopper chopping tool industry or Late Acheulean"? *Quaternary International* 321: 3 - 11.

Yang, S.X., Hou, Y.M., Pelegrin, J. 2016. A late Acheulean Culture on the Chinese Loess plateau: The techno-economic behaviour of the Dingcun lithic industry. *Quaternary International* 400: 73 - 85.

Yuan, B., Xia, Z., Li, B., Qiao, Y., Gu, Z., Zhang, J., Xu, B., Huang, W., Zeng, R. 2008. Chronostratigraphy and stratigraphic division of red soil in Southern China. *Quaternary Sciences* 28(1): 1 - 12. (Chinese, with English Abstract).

Zhou, Z., Wang, C., Goa, X. 2009. A preliminary report on the excavation of the Beitaishanmiao Paleolithic site at Danjiangkou Reservoir Region, south China. *Acta Anthropologica Sinica* 28(3): 246 - 261. (Chinese with English Abstract).

Zhou, Z., Huan, Y., Shao, Y., Dai, Y., Yang, H. 2014. Heat treated stone artifacts at Shuidonggou, Northwest China and their archaeological implications. *Quaternary International* 347: 84 - 90.

Zhu, Z.D. 1955. Valley landscape of Hanjiang river upstream between Danjiangkou to Baihe. *Acta Geographica Sinica* 21(3): 259 - 270 (Chinese, with English abstract).

Zipkin, A.M., Ambrose, S.H., Hanchar, J.M., Piccoli, P.M., Brooks, A.S., Anthony, E.Y. 2017. Elemental fingerprinting of Kenya Rift Valley ochre deposits for provenance studies of rock art and archaeological pigments. *Quaternary International* 430: 42 - 59.

**APPENDIX: Complements of reviewer two, may they have eternal happiness.**

**Table 1: Sterkfontein Oldowan quartzite raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **vf** | **f** | **m** | **c** | **vc** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2371** | Proto biface | 0 | 14 | 0.0 | **2371** | Proto biface | 1 | | | | | **2371** | Proto biface | 1 | | |
| **2502** | Chopper | 3 | 4 | 75.0 | **2456** | retouch | | 1 | | | | **2456** | retouch | 1 | | |
| **2932** | Chopper | 0 | 20 | 0.0 | **2502** | Chopper | | | | 1 | | **2502** | Chopper | 1 | | |
| **4920** | Chopper | 5 | 19 | 26.3 | **2503** | flake | | 1 | | | | **2503** | flake | | 1 | |
| **2533** | chunk | 1 | 2 | 50.0 | **2532** | flake | | | 1 | | | **2532** | flake | | 1 | |
| **2938** | chunk | 2 | 17 | 11.8 | **2533** | chunk | | 1 | | | | **2533** | chunk | 1 | | |
| **3683** | chunk | 1 | 5 | 20.0 | **2630** | retouch | | | 1 | | | **2630** | retouch | | 1 | |
| **6010** | chunk | 1 | 11 | 9.1 | **2647** | retouch | | | 1 | | | **2647** | retouch | 1 | | |
| **8198** | chunk | 1 | 10 | 10.0 | **2695** | flake | | 1 | | | | **2695** | flake | 1 | | |
| **8199** | chunk | 3 | 5 | 60.0 | **2722** | flake | | | 1 | | | **2722** | flake | 1 | | |
| **8904** | chunk | 3 | 3 | 100.0 | **2739** | retouch | | 1 | | | | **2739** | retouch | | 1 | |
| **10054** | chunk | 3 | 6 | 50.0 | **2740** | chunk | | 1 | | | | **2740** | chunk | | 1 | |
| **2789** | cutting | 1 | 10 | 10.0 | **2770** | flake | | 1 | | | | **2770** | flake | | 1 | |
| **2722** | flake | 0 | 3 | 0.0 | **2789** | cutting | | 1 | | | | **2789** | cutting | | 1 | |
| **2740** | flake | 5.5 | 11 | 50.0 | **2812** | retouch | | | 1 | | | **2812** | retouch | | 1 | |
| **2770** | flake | 2 | 2 | 100.0 | **2885** | retouch | | 1 | | | | **2885** | retouch | | 1 | |
| **3050** | flake | 0 | 5 | 0.0 | **2886** | retouch | | 1 | | | | **2886** | retouch | | 1 | |
| **3102** | flake | 2.5 | 5.5 | 45.5 | **2932** | Chopper | | | 1 | | | **2932** | Chopper | 1 | | |
| **3347** | flake | 0 | 8 | 0.0 | **2938** | chunk | | 1 | | | | **2938** | chunk | | 1 | |
| **3348** | flake | 1 | 6 | 16.7 | **3019** | Irregular polyhedral | | | 1 | | | **3019** | Irregular polyhedral | | | 1 |
| **3350** | flake | 0 | 3 | 0.0 | **3049** | retouch | | | 1 | | | **3049** | retouch | 1 | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3351** | flake | 0 | 5 | 0.0 | **3050** | flake | | 1 | | | | **3050** | flake | 1 | | |
| **3352** | flake | 0 | 5 | 0.0 | **3051** | retouch | | 1 | | | | **3051** | retouch | 1 | | |
| **3384** | flake | 1 | 6 | 16.7 | **3102** | flake | 1 | | | | | **3102** | flake | 1 | | |
| **3385** | flake | 1 | 7 | 14.3 | **3239** | flake | | 1 | | | | **3239** | flake | | 1 | |
| **3480** | flake | 0 | 4 | 0.0 | **3347** | flake | | 1 | | | | **3347** | flake | 1 | | |
| **3676** | flake | 0 | 7 | 0.0 | **3348** | flake | | | 1 | | | **3348** | flake | | 1 | |
| **3803** | flake | 0 | 6 | 0.0 | **3349** | retouch | | 1 | | | | **3349** | retouch | 1 | | |
| **5886** | flake | 0 | 5 | 0.0 | **3350** | flake | | | | 1 | | **3350** | flake | 1 | | |
| **5887** | flake | 0 | 5 | 0.0 | **3351** | flake | | | 1 | | | **3351** | flake | 1 | | |
| **5913** | flake | 0 | 6 | 0.0 | **3352** | retouch | | 1 | | | | **3352** | retouch | 1 | | |
| **5949** | flake | 0 | 8 | 0.0 | **3381** | flake | | | 1 | | | 3381 | flake | | 1 | |
| **5951** | flake | 0 | 6 | 0.0 | **3382** | flake | | 1 | | | | **3382** | flake | | 1 | |
| **6091** | flake | 0 | 6 | 0.0 | **3384** | flake | | 1 | | | | **3384** | flake | | 1 | |
| **6099** | flake | 0 | 6 | 0.0 | **3385** | flake | | 1 | | | | **3385** | flake | | 1 | |
| **6122** | flake | 3 | 6 | 50.0 | **3479** | flake | | | 1 | | | **3479** | flake | | 1 | |
| **7962** | flake | 0 | 7 | 0.0 | **3480** | flake | | 1 | | | | **3480** | flake | 1 | | |
| **8521** | flake | 0 | 11 | 0.0 | **3676** | flake | | 1 | | | | **3676** | flake | | 1 | |
| **8847** | flake | 2 | 4 | 50.0 | **3683** | chunk | | 1 | | | | **3683** | chunk | | 1 | |
| **8849** | Flake | 3 | 11 | 27.3 | **3794** | retouch | | | 1 | | | **3794** | retouch | 1 | | |
| **8851** | flake | 2 | 5 | 40.0 | **3803** | flake | | | 1 | | | **3803** | flake | | 1 | |
| **8905** | flake | 1 | 2 | 50.0 | **4920** | Chopper | | 1 | | | | **4920** | Chopper | | 1 | |
| **9073** | flake | 0 | 1 | 0.0 | **5069** | retouch | | | 1 | | | **5069** | retouch | | 1 | |
| **9074** | flake | 1 | 1 | 100.0 | **5886** | flake | | 1 | | | | **5886** | flake | 1 | | |
| **2951a** | flake | 2 | 10 | 20.0 | **5887** | flake | | 1 | | | | **5887** | flake | | 1 | |
| **2503** | Flake | 1 | 4 | 25.0 | **5892** | retouch | | 1 | | | | **5892** | retouch | | 1 | |
| **3239** | flake | 0 | 5 | 0.0 | **5913** | retouch | | | 1 | | | **5913** | retouch | | 1 | |
| **2456** | flake used | 0 | 14 | 0.0 | **5949** | flake | | | 1 | | | **5949** | flake | 1 | | |
| **2532** | Flake used | 0 | 10 | 0.0 | **5951** | flake | | | 1 | | | **5951** | flake | 1 | | |
| **2630** | flake used | 0 | 7 | 0.0 | **6010** | chunk | | 1 | | | | **6010** | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2885** | flake used | 0 | 12 | 0.0 | **6085** | retouch | | 1 | | | | **6085** | retouch | | 1 | |
| **2886** | flake used | 0 | 21 | 0.0 | **6091** | flake | | 1 | | | | **6091** | flake | | 1 | |
| **3349** | flake used | 0 | 9 | 0.0 | **6099** | flake | | | 1 | | | **6099** | flake | | 1 | |
| **3479** | flake used | 0 | 10 | 0.0 | **6101** | flake | | 1 | | | | **6101** | flake | | 1 | |
| **6085** | flake used | 1 | 20 | 5.0 | **6120** | retouch | | 1 | | | | **6120** | retouch | 1 | | |
| **6120** | flake used | 0 | 13 | 0.0 | **6122** | flake | | 1 | | | | **6122** | flake | | 1 | |
| **3049** | flake used/retouch | 0 | 15 | 0.0 | **6197** | retouch | | 1 | | | | **6197** | retouch | | 1 | |
| **3051** | flake used/retouch | 4 | 19 | 21.1 | **6211** | retouch | | 1 | | | | **6211** | retouch | 1 | | |
| **7975** | Flake, used | 1 | 20 | 5.0 | **7962** | flake | | | 1 | | | **7962** | flake | | 1 | |
| **2739** | Flake, used /retouch | 1.5 | 10.5 | 14.3 | **7975** | retouch | | | 1 | | | **7975** | retouch | 1 | | |
| **2812** | flake/ used | 0 | 9 | 0.0 | **8198** | chunk | | | 1 | | | **8198** | chunk | | 1 | |
| **3381** | flake/ used | 4 | 10 | 40.0 | **8199** | chunk | | | | | 1 | **8199** | chunk | | | 1 |
| **3382** | flake/ used | 0 | 7 | 0.0 | **8432** | retouch | | | 1 | | | **8432** | retouch | | 1 | |
| **6101** | flake/ used | 1 | 8 | 12.5 | **8521** | flake | | | 1 | | | **8521** | flake | | 1 | |
| **3019** | Irregular polyhedral | 4 | 12 | 33.3 | **8841** | Irregular polyhedral | | | | 1 | | **8841** | Irregular polyhedral | 1 | | |
| **8841** | Irregular polyhedral | 0 | 5 | 0.0 | **8847** | flake | | 1 | | | | **8847** | flake | 1 | | |
| **8854** | Irregular polyhedral | 1 | 18 | 5.6 | **8848** | retouch | | 1 | | | | **8848** | retouch | | 1 | |
| **2647** | retouch | 0 | 7 | 0.0 | **8849** | retouch | | 1 | | | | **8849** | retouch | 1 | | |
| **3794** | retouch | 0 | 17 | 0.0 | **8851** | flake | | 1 | | | | **8851** | flake | | | 1 |
| **5069** | retouch | 0 | 18 | 0.0 | **8854** | Irregular polyhedral | | 1 | | | | **8854** | Irregular polyhedral | | 1 | |
| **5892** | retouch | 1 | 20 | 5.0 | **8904** | chunk | | | 1 | | | **8904** | chunk | | | 1 |
| **6197** | retouch | 0 | 8 | 0.0 | **8905** | flake | | 1 | | | | **8905** | flake | | 1 | |
| **6211** | retouch | 1 | 21 | 4.8 | **8907** | retouch | | 1 | | | | **8907** | retouch | | 1 | |
| **8432** | retouch | 1 | 14 | 7.1 | **9073** | flake | | | 1 | | | **9073** | flake | | | 1 |
| **8848** | retouch | 1 | 17 | 5.9 | **9074** | flake | | 1 | | | | **9074** | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8907** | retouch | 0 | 8 | 0.0 | **10054** | chunk | | 1 | | | | **10054** | chunk | | 1 | |
| **2695** | used flake | 0 | 6 | 0.0 | **2951a** | flake | | | 1 | | | **2951a** | flake | | 1 | |
| | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **n** | | | | |
| **77** | | | | 26.4% | **77** | | 2 | 44 | 27 | 3 | 1 | **77** | | 28 | 43 | 6 |
| | | | | | | Percentage of sample | 2.6 | 57.1 | 35.1 | 3.9 | 1.3 | | Percentage of sample | 36.4 | 55.8 | 7.8 |

**Table 2: Sterkfontein Oldowan quartz raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **W, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3372** | chunk | 3 | 3 | 100.0 | **2457** | core, p | 6 | 36 | 31 | 11.2 | 0.5 | 5.4 | **2457** | core, p | 1 | | |
| **3677** | chunk | 3 | 9 | 33.3 | **2487** | core, pi | 2 | 26 | 26 | 6.8 | 0.3 | 3.0 | **2487** | core, pi | 1 | | |
| **3796** | chunk | 2 | 2 | 100.0 | **2629** | core, p | 3 | 29 | 29 | 8.4 | 0.4 | 3.6 | **2629** | core, p | 1 | | |
| **6236** | chunk | 1 | 5 | 20.0 | **2693** | core, casual | 0 | 23 | 23 | 5.3 | 0.0 | 0.0 | **2693** | core, casual | 1 | | |
| **6238** | chunk | 1 | 4 | 25.0 | **2696** | flake | 1 | 17 | 10.8 | 1.8 | 0.5 | 5.4 | **2696** | flake | 1 | | |
| **7978** | chunk | 1 | 7 | 14.3 | **2771** | core, bip | 1 | 25 | 20 | 5.0 | 0.2 | 2.0 | **2771** | core, bip | 1 | | |
| **7982** | chunk | 4 | 14 | 28.6 | **2792** | core, cent | 1 | 22 | 20 | 4.4 | 0.2 | 2.3 | **2792** | core, cent | 1 | | |
| **7987** | chunk | 2 | 10 | 20.0 | **2810** | flake | 2 | 26 | 17 | 4.4 | 0.5 | 4.5 | **2810** | flake | 1 | | |
| **8071** | chunk | 2 | 3 | 66.7 | **2811** | flake | 1 | 22 | 17 | 3.7 | 0.3 | 2.7 | **2811** | flake | 1 | | |
| **8074** | chunk | 0 | 10 | 0.0 | **2903** | core, p | 5 | 50 | 44 | 22.0 | 0.2 | 2.3 | **2903** | core, p | 1 | | |
| **8076** | chunk | 1 | 8 | 12.5 | **2943** | flake | 4 | 25 | 21 | 5.3 | 0.8 | 7.6 | **2943** | flake | | 1 | |
| **8994** | chunk | 0 | 8 | 0.0 | **2979** | cutting | 7 | 11.5 | 11.5 | 1.3 | 5.3 | 52.9 | **2979** | cutting | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **9142** | chunk | 1 | 9 | 11.1 | **3065** | core, cent | 1 | 33 | 33 | 10.9 | 0.1 | 0.9 | **3065** | core, cent | 1 | | |
| **9227** | chunk | 0 | 8 | 0.0 | **3206** | scraper | 0 | 22 | 15 | 3.3 | 0.0 | 0.0 | **3206** | scraper | 1 | | |
| **10250** | chunk | 0 | 4 | 0.0 | **3353** | flake | 3 | 12.3 | 10 | 1.2 | 2.4 | 24.4 | **3353** | flake | | | 1 |
| **2771** | core, bip | 0 | 14 | 0.0 | **3354** | flake | 1 | 18 | 14.3 | 2.6 | 0.4 | 3.9 | **3354** | flake | 1 | | |
| **3708** | core, bip | 11 | 19 | 57.9 | **3355** | retouch | 1 | 15.3 | 15 | 2.3 | 0.4 | 4.4 | **3355** | retouch | 1 | | |
| **6212** | core, bip | 1 | 3 | 33.3 | **3366** | scraper | 4 | 21.5 | 12 | 2.6 | 1.6 | 15.5 | **3366** | scraper | 1 | | |
| **2693** | core, casual | 0 | 13 | 0.0 | **3368** | flake | 1 | 28 | 27 | 7.6 | 0.1 | 1.3 | **3368** | flake | 1 | | |
| **2792** | core, cent | 3 | 16 | 18.8 | **3369** | retouch | 2 | 18 | 14.5 | 2.6 | 0.8 | 7.7 | **3369** | retouch | 1 | | |
| **3065** | core, cent | 4 | 22 | 18.2 | **3370** | flake | 1 | 17.2 | 12.4 | 2.1 | 0.5 | 4.7 | **3370** | flake | 1 | | |
| **3977** | core, cent | 1 | 13 | 7.7 | **3371** | retouch | 1 | 20.7 | 10.4 | 2.2 | 0.5 | 4.6 | **3371** | retouch | 1 | | |
| **5003** | core, frag | 7 | 18 | 38.9 | **3705** | core, p | 3 | 50 | 50 | 25.0 | 0.1 | 1.2 | **3705** | core, p | 1 | | |
| **8075** | core, frag | 3 | 11 | 27.3 | **3708** | core, bip | 4 | 46 | 32 | 14.7 | 0.3 | 2.7 | **3708** | core, bip | | 1 | |
| **2457** | core, p | 5 | 21 | 23.8 | **3977** | core, cent | 1 | 57 | 42 | 23.9 | 0.0 | 0.4 | **3977** | core, cent | 1 | | |
| **2629** | core, p | 5 | 18 | 27.8 | **4965** | core, p | 5 | 100 | 77.7 | 77.7 | 0.1 | 0.6 | **4965** | core, p | 1 | | |
| **2903** | core, p | 15 | 31 | 48.4 | **5003** | core, frag | 5 | 38 | 38 | 14.4 | 0.3 | 3.5 | **5003** | core, frag | 1 | | |
| **3705** | core, p | 1 | 9 | 11.1 | **5914** | flake | 5 | 19.6 | 13.7 | 2.7 | 1.9 | 18.6 | **5914** | flake | 1 | | |
| **4965** | core, p | 6 | 35 | 17.1 | **6212** | core, bip | 15 | 10 | 10 | 1.0 | 15.0 | 150.0 | **6173** | flake | 1 | | |
| **7334** | core, p | 4 | 17 | 23.5 | **7229** | scraper | 2 | 10 | 10 | 1.0 | 2.0 | 20.0 | **6212** | core, bip | | | 1 |
| **2487** | core, pi | 5 | 14 | 35.7 | **7334** | core, p | 2 | 40 | 40 | 16.0 | 0.1 | 1.3 | **6233** | flake | 1 | | |
| **2979** | cutting | 1 | 8 | 12.5 | **7970** | retouch | 1 | 29.7 | 15 | 4.5 | 0.2 | 2.2 | **6236** | chunk | 1 | | |
| **2419** | flake | 0 | 2 | 0.0 | **7971** | flake | 2 | 20 | 15 | 3.0 | 0.7 | 6.7 | **6238** | chunk | 1 | | |
| **2421** | flake | 0 | 6 | 0.0 | **7978** | chunk | 2 | 27 | 25 | 6.8 | 0.3 | 3.0 | **6253** | flake | | 1 | |
| **2460** | flake | 0 | 5 | 0.0 | **7982** | chunk | 3 | 21 | 13 | 2.7 | 1.1 | 11.0 | **6559** | flake | | 1 | |
| **2490** | flake | 0 | 5 | 0.0 | **7983** | retouch | 1 | 16.2 | 12 | 1.9 | 0.5 | 5.1 | **6560** | retouch | 1 | | |
| **2504** | flake | 0 | 2 | 0.0 | **7987** | chunk | 3 | 20.2 | 11.7 | 2.4 | 1.3 | 12.7 | **7082** | retouch | 1 | | |
| **2530** | flake | 0 | 6 | 0.0 | **8068** | flake | 4 | 14.7 | 13.4 | 2.0 | 2.0 | 20.3 | **7181** | flake | 1 | | |
| **2531** | flake | 0 | 3 | 0.0 | **8069** | flake | 2 | 25 | 14.3 | 3.6 | 0.6 | 5.6 | 7191 | retouch | 1 | | |
| **2581** | flake | 0 | 11 | 0.0 | **8070** | flake | 1 | 17 | 14.2 | 2.4 | 0.4 | 4.1 | **7229** | scraper | 1 | | |
| **2675** | flake | 0 | 5 | 0.0 | **8071** | chunk | 4 | 20.5 | 12 | 2.5 | 1.6 | 16.3 | **7334** | core, p | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2696** | flake | 2 | 7 | 28.6 | **8072** | retouch | 1 | 23.3 | 10.6 | 2.5 | 0.4 | 4.0 | **7970** | retouch | 1 | | |
| **2741** | flake | 4 | 7 | 57.1 | **8073** | retouch | 3 | 19.8 | 14.5 | 2.9 | 1.0 | 10.4 | **7971** | flake | 1 | | |
| **2742** | flake | 0 | 4 | 0.0 | **8074** | chunk | 3 | 31 | 19.7 | 6.1 | 0.5 | 4.9 | **7978** | chunk | 1 | | |
| **2774** | flake | 0 | 3 | 0.0 | **8075** | core, frag | 2 | 24.4 | 16 | 3.9 | 0.5 | 5.1 | **7982** | chunk | 1 | | |
| **2799** | flake | 3 | 9 | 33.3 | **8076** | chunk | 1 | 22.2 | 11 | 2.4 | 0.4 | 4.1 | **7983** | retouch | 1 | | |
| **2801** | flake | 2 | 3 | 66.7 | **8192** | flake | 1 | 18.2 | 11.2 | 2.0 | 0.5 | 4.9 | **7987** | chunk | 1 | | |
| **2811** | flake | 0 | 5 | 0.0 | **8193** | flake | 0 | 14.5 | 9 | 1.3 | 0.0 | 0.0 | **8068** | flake | 1 | | |
| **2888** | flake | 0 | 6 | 0.0 | **8195** | flake | 0 | 16.1 | 14 | 2.3 | 0.0 | 0.0 | **8069** | flake | 1 | | |
| **2890** | flake | 0 | 6 | 0.0 | **8197** | flake | 4 | 18.3 | 12 | 2.2 | 1.8 | 18.2 | **8070** | flake | 1 | | |
| **2943** | flake | 3 | 8 | 37.5 | **8571** | flake | 1 | 22 | 22 | 4.8 | 0.2 | 2.1 | **8071** | chunk | 1 | | |
| **2946** | flake | 1 | 6 | 16.7 | **8990** | flake | 1 | 19.6 | 16 | 3.1 | 0.3 | 3.2 | **8072** | retouch | 1 | | |
| **2981** | flake | 2 | 6 | 33.3 | **8991** | flake | 1 | 24 | 14.8 | 3.6 | 0.3 | 2.8 | **8073** | retouch | 1 | | |
| **3057** | flake | 0 | 7 | 0.0 | **8992** | flake | 1 | 28 | 7 | 2.0 | 0.5 | 5.1 | **8074** | chunk | 1 | | |
| **3066** | flake | 0 | 4 | 0.0 | **8993** | flake | 1 | 17 | 11 | 1.9 | 0.5 | 5.3 | **8075** | core, frag | 1 | | |
| **3067** | flake | 0 | 10 | 0.0 | **8994** | chunk | 0 | 18.6 | 9.7 | 1.8 | 0.0 | 0.0 | **8076** | chunk | 1 | | |
| **3068** | flake | 0 | 7 | 0.0 | **8995** | retouch | 2 | 31.5 | 13.6 | 4.3 | 0.5 | 4.7 | **8192** | flake | 1 | | |
| **3069** | Flake | 0 | 5 | 0.0 | **8996** | flake | 1 | 21.6 | 5.5 | 1.2 | 0.8 | 8.4 | **8193** | flake | 1 | | |
| **3099** | flake | 3 | 5 | 60.0 | **8997** | retouch | 1 | 18 | 14.2 | 2.6 | 0.4 | 3.9 | **8195** | flake | 1 | | |
| **3109** | flake | 2 | 2 | 100.0 | **8998** | flake | 16 | 9.6 | 9.3 | 0.9 | 17.9 | 179.2 | **8197** | flake | 1 | | |
| **3172** | flake | 0 | 5 | 0.0 | **9072** | flake | 1 | 13.8 | 13 | 1.8 | 0.6 | 5.6 | **8571** | flake | 1 | | |
| **3173** | flake | 2 | 5 | 40.0 | **9140** | retouch | 2 | 16.5 | 11 | 1.8 | 1.1 | 11.0 | **8990** | flake | 1 | | |
| **3174** | flake | 0 | 5 | 0.0 | **9141** | retouch | 0 | 17.2 | 14.5 | 2.5 | 0.0 | 0.0 | **8991** | flake | 1 | | |
| **3201** | flake | 6 | 12 | 50.0 | **9142** | chunk | 1 | 21 | 6 | 1.3 | 0.8 | 7.9 | **8992** | flake | 1 | | |
| **3203** | flake | 0 | 2 | 0.0 | **9226** | retouch | 3 | 18 | 12.8 | 2.3 | 1.3 | 13.0 | **8993** | flake | 1 | | |
| **3205** | flake | 0 | 6 | 0.0 | **9227** | chunk | 1 | 21 | 9.7 | 2.0 | 0.5 | 4.9 | **8994** | chunk | 1 | | |
| **3253** | Flake | 1 | 6 | 16.7 | **10250** | chunk | 14 | 17 | 10.2 | 1.7 | 8.1 | 80.7 | **8995** | retouch | 1 | | |
| **3304** | flake | 1 | 6 | 16.7 | **10251** | flake | 1 | 25.4 | 11.8 | 3.0 | 0.3 | 3.3 | **8996** | flake | 1 | | |
| **3305** | flake | 0 | 4 | 0.0 | **10272** | retouch | 11 | 19.7 | 15 | 3.0 | 3.7 | 37.2 | **8997** | retouch | 1 | | |
| **3312** | flake | 0 | 6 | 0.0 | **10273** | flake | 5 | 21 | 15.8 | 3.3 | 1.5 | 15.1 | **8998** | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3313** | flake | 2 | 7 | 28.6 | **10280** | flake | 4 | 22 | 15 | 3.3 | 1.2 | 12.1 | **9072** | flake | 1 | | |
| **3353** | flake | 5 | 5 | 100.0 | **7191** | retouch | 2 | 18.6 | 14.7 | 2.7 | 0.7 | 7.3 | **9140** | retouch | 1 | | |
| **3354** | flake | 1 | 4.5 | 22.2 | **7181** | flake | 0 | 15 | 12.2 | 1.8 | 0.0 | 0.0 | **9141** | retouch | 1 | | |
| **3368** | flake | 0 | 10 | 0.0 | **7082** | retouch | 0 | 18.4 | 8.2 | 1.5 | 0.0 | 0.0 | **9142** | chunk | 1 | | |
| **3370** | flake | 0 | 7 | 0.0 | **6173** | flake | 10 | 24.4 | 16.6 | 4.1 | 2.5 | 24.7 | **9226** | retouch | 1 | | |
| **3383** | flake | 0 | 4 | 0.0 | **6560** | retouch | 6 | 28.6 | 15.4 | 4.4 | 1.4 | 13.6 | **9227** | chunk | 1 | | |
| **3386** | flake | 0 | 8 | 0.0 | **6559** | flake | 4 | 20 | 13.6 | 2.7 | 1.5 | 14.7 | **10250** | chunk | 1 | | |
| **3412** | flake | 3 | 4 | 75.0 | **6253** | flake | 3 | 21.3 | 20.6 | 4.4 | 0.7 | 6.8 | **10251** | flake | 1 | | |
| **3450** | flake | 4 | 8 | 50.0 | **6236** | chunk | 3 | 16.3 | 13.2 | 2.2 | 1.4 | 13.9 | **10272** | retouch | 1 | | |
| **3477** | flake | 2 | 4 | 50.0 | **6238** | chunk | 1 | 15.7 | 9.1 | 1.4 | 0.7 | 7.0 | **10273** | flake | | 1 | |
| **3478** | flake | 0 | 2 | 0.0 | **6233** | chunk | 10 | 31.4 | 17.6 | 5.5 | 1.8 | 18.1 | **10280** | flake | 1 | | |
| **3675** | flake | 0 | 6 | 0.0 | | | | | | | | | | | | | |
| **3678** | Flake | 4 | 7 | 57.1 | | | | | | | | | | | | | |
| **3680** | flake | 2 | 3 | 66.7 | | | | | | | | | | | | | |
| **3711** | flake | 0 | 5 | 0.0 | | | | | | | | | | | | | |
| **3712** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **3855** | flake | 2 | 4 | 50.0 | | | | | | | | | | | | | |
| **3857** | flake | 6 | 7 | 85.7 | | | | | | | | | | | | | |
| **4969** | Flake | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **4971** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **5005** | flake | 0 | 1 | 0.0 | | | | | | | | | | | | | |
| **5006** | flake | 0 | 2 | 0.0 | | | | | | | | | | | | | |
| **5872** | flake | 1 | 5 | 20.0 | | | | | | | | | | | | | |
| **5902** | flake | 1 | 1 | 100.0 | | | | | | | | | | | | | |
| **5914** | flake | 2 | 5 | 40.0 | | | | | | | | | | | | | |
| **5953** | flake | 0 | 2 | 0.0 | | | | | | | | | | | | | |
| **6048** | flake | 0 | 2 | 0.0 | | | | | | | | | | | | | |
| **6049** | flake | 3 | 9 | 33.3 | | | | | | | | | | | | | |
| **6090** | flake | 0 | 6 | 0.0 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6103** | flake | 3 | 7 | 42.9 | | | | | | | | | | | | | |
| **6104** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **6129** | flake | 1 | 7 | 14.3 | | | | | | | | | | | | | |
| **6173** | flake | 3 | 3 | 100.0 | | | | | | | | | | | | | |
| **6233** | flake | 3.5 | 6 | 58.3 | | | | | | | | | | | | | |
| **6253** | flake | 1 | 1 | 100.0 | | | | | | | | | | | | | |
| **6559** | flake | 2 | 5 | 40.0 | | | | | | | | | | | | | |
| **7971** | flake | 2 | 6 | 33.3 | | | | | | | | | | | | | |
| **8068** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **8069** | flake | 0 | 6 | 0.0 | | | | | | | | | | | | | |
| **8070** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **8072** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **8192** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **8193** | flake | 0 | 3 | 0.0 | | | | | | | | | | | | | |
| **8195** | flake | 1 | 4 | 25.0 | | | | | | | | | | | | | |
| **8197** | flake | 0 | 4 | 0.0 | | | | | | | | | | | | | |
| **8339** | flake | 0 | 6 | 0.0 | | | | | | | | | | | | | |
| **8483** | flake | 4 | 5 | 80.0 | | | | | | | | | | | | | |
| **8526** | flake | 0 | 7 | 0.0 | | | | | | | | | | | | | |
| **8564** | flake | 0 | 5 | 0.0 | | | | | | | | | | | | | |
| **8571** | flake | 0 | 2 | 0.0 | | | | | | | | | | | | | |
| **8855** | flake | 4 | 11 | 36.4 | | | | | | | | | | | | | |
| **8990** | flake | 5 | 11 | 45.5 | | | | | | | | | | | | | |
| **8991** | flake | 2 | 8 | 25.0 | | | | | | | | | | | | | |
| **8992** | flake | 0 | 6 | 0.0 | | | | | | | | | | | | | |
| **8993** | flake | 0 | 10 | 0.0 | | | | | | | | | | | | | |
| **8996** | flake | 0 | 2 | 0.0 | | | | | | | | | | | | | |
| **8997** | flake | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **8998** | flake | 3 | 6 | 50.0 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **9072** | flake | 0 | 7 | 0.0 | | | | | | | | | | | | | |
| **10251** | flake | 0 | 9 | 0.0 | | | | | | | | | | | | | |
| **10273** | flake | 3 | 10 | 30.0 | | | | | | | | | | | | | |
| **10280** | flake | 0 | 7 | 0.0 | | | | | | | | | | | | | |
| **2808** | flake used | 1 | 13 | 7.7 | | | | | | | | | | | | | |
| **5007** | flake used | 0 | 5 | 0.0 | | | | | | | | | | | | | |
| **2904** | flake/ used /retouched | 0 | 12 | 0.0 | | | | | | | | | | | | | |
| **3371** | flake/ used /retouched | 0 | 9 | 0.0 | | | | | | | | | | | | | |
| **3369** | retouch | 0 | 12 | 0.0 | | | | | | | | | | | | | |
| **3656** | retouch | 1 | 4 | 25.0 | | | | | | | | | | | | | |
| **6560** | retouch | 1 | 7 | 14.3 | | | | | | | | | | | | | |
| **7082** | retouch | 1 | 14 | 7.1 | | | | | | | | | | | | | |
| **7187** | retouch | 1 | 13 | 7.7 | | | | | | | | | | | | | |
| **7191** | retouch | 2 | 5 | 40.0 | | | | | | | | | | | | | |
| **7970** | retouch | 4 | 16 | 25.0 | | | | | | | | | | | | | |
| **7983** | retouch | 0 | 12 | 0.0 | | | | | | | | | | | | | |
| **8073** | retouch | 0 | 12 | 0.0 | | | | | | | | | | | | | |
| **8995** | retouch | 3 | 9 | 33.3 | | | | | | | | | | | | | |
| **9140** | retouch | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **9141** | retouch | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **9226** | retouch | 0 | 6 | 0.0 | | | | | | | | | | | | | |
| **10272** | retouch | 3 | 14 | 21.4 | | | | | | | | | | | | | |
| **2810** | retouched | 3 | 8.5 | 35.3 | | | | | | | | | | | | | |
| **3206** | scraper | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **3355** | scraper | 0 | 8 | 0.0 | | | | | | | | | | | | | |
| **3366** | scraper | 5 | 25 | 20.0 | | | | | | | | | | | | | |
| **3388** | scraper | 0 | 14 | 0.0 | | | | | | | | | | | | | |
| **6121** | scraper | 0 | 15 | 0.0 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7229** | scraper | 11 | 17 | 64.7 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **157** | | | | 20.1% | **81** | | | | | | | 12.4 | **81** | | 72 | 7 | 2 |
| | | | | | | | | | | | | | | Percentage of sample | 88.9 | 8.6 | 2.5 |

**Table 3: Sterkfontein Oldowan chert raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **W, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2580** | flake | 1 | 6 | 16.7 | **2832** | flake | 0 | 23.6 | 19.6 | 4.6 | 0.0 | 0.0 | **2832** | flake | | 1 | |
| **8795** | chunk | 2 | 7 | 28.6 | **2833** | flake | 0 | 41.8 | 37.6 | 15.7 | 0.0 | 0.0 | **2833** | flake | | 1 | |
| **7282** | cutting | 6 | 14 | 42.9 | **3238** | retouch | 1 | 47.3 | 38.4 | 18.2 | 0.1 | 0.6 | **3238** | retouch | | 1 | |
| **2832** | flake | 0 | 1 | 0.0 | **3338** | flake | 0 | 39.2 | 21 | 8.2 | 0.0 | 0.0 | **3338** | flake | | 1 | |
| **2833** | flake | 1 | 3 | 33.3 | **3411** | flake | 1 | 33.4 | 31.8 | 10.6 | 0.1 | 0.9 | **3411** | flake | | 1 | |
| **3338** | flake | 0 | 9 | 0.0 | **3594** | flake | 1 | 23.2 | 21.2 | 4.9 | 0.2 | 2.0 | **3594** | flake | | 1 | |
| **3411** | flake | 4 | 8.5 | 47.1 | **3639** | retouch | 3 | 26 | 14.8 | 3.8 | 0.8 | 7.8 | **3639** | retouch | | 1 | |
| **6230** | flake | 0 | 4 | 0.0 | **3641** | retouch | 1 | 24.8 | 14.3 | 3.5 | 0.3 | 2.8 | **3641** | retouch | | 1 | |
| **7318** | flake | 0 | 8 | 0.0 | **6230** | flake | 1 | 43.4 | 29.8 | 12.9 | 0.1 | 0.8 | **6230** | flake | 1 | | |
| **7337** | flake | 3 | 7 | 42.9 | **7282** | cutting | 2 | 33.8 | 32.6 | 11.0 | 0.2 | 1.8 | **7282** | cutting | | 1 | |
| **8740** | flake | 0 | 6 | 0.0 | **7318** | flake | 1 | 27.8 | 25.7 | 7.1 | 0.1 | 1.4 | **7318** | flake | | 1 | |
| **8784** | flake | 1 | 6 | 16.7 | **7337** | flake | 1 | 18.7 | 8.8 | 1.6 | 0.6 | 6.1 | **7337** | flake | 1 | | |
| **9261** | flake | 0 | 7 | 0.0 | **8724** | retouch | 1 | 38.2 | 37.5 | 14.3 | 0.1 | 0.7 | **8724** | retouch | | 1 | |
| **3594** | flake used | 3.5 | 9 | 38.9 | **8740** | flake | 1 | 24 | 27 | 6.5 | 0.2 | 1.5 | **8740** | flake | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **3238** | retouch | 2 | 22 | 9.1 | **8743** | retouch | 1 | 17.2 | 14 | 2.4 | 0.4 | 4.2 | **8743** | retouch | 1 | |
| **3641** | retouch | 1.5 | 7.5 | 20.0 | **8752** | retouch | 0 | 41.1 | 37 | 15.2 | 0.0 | 0.0 | **8752** | retouch | | 1 |
| **8724** | retouch | 2 | 6 | 33.3 | **8784** | flake | 1 | 18.7 | 16.5 | 3.1 | 0.3 | 3.2 | **8784** | flake | | 1 |
| **8743** | retouch | 0 | 10 | 0.0 | **8795** | chunk | 1 | 16 | 11 | 1.8 | 0.6 | 5.7 | **8795** | chunk | 1 | |
| **8752** | retouch | 1 | 13 | 7.7 | **9261** | flake | 1 | 33 | 24 | 7.9 | 0.1 | 1.3 | **9261** | flake | 1 | |
| **10544** | retouch | 1 | 11 | 9.1 | **10544** | retouch | 1 | 16.7 | 10.4 | 1.7 | 0.6 | 5.8 | **10544** | retouch | | 1 |
| **3639** | retouched | 2.5 | 13.5 | 18.5 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | |
| **21** | | | | 17.4% | **20** | | | | | | | 2.3 | **20** | | 6 | 14 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 30.0 | 70.0 | 0.0 |

**Table 4: Sterkfontein Acheulean quartzite raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; g – granules; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **vf** | **f** | **m** | **c** | **vc** | **g** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9232 | chunk | 1 | 3 | 33.3 | 9232 | chunk | | 1 | | | | | 9232 | chunk | | 1 | |
| 9484 | chunk | 0 | 2 | 0.0 | 9484 | chunk | | | | 1 | | | 9511 | chunk | | 1 | |
| 9511 | chunk | 2 | 2 | 100.0 | 9511 | chunk | | | 1 | | | | 9484 | chunk | | | 1 |
| 2060 | cleaver | 0 | 21 | 0.0 | 2060 | cleaver | | | 1 | | | | 10363 | cleaver | 1 | | |
| 2066 | cleaver | 1 | 26 | 3.8 | 2066 | cleaver | | | 1 | | | | 10521 | cleaver | 1 | | |
| 10016 | cleaver | 0 | 19 | 0.0 | 10016 | cleaver | 1 | | | | | | 2060 | cleaver | 1 | | |
| 10363 | cleaver | 3 | 17 | 17.6 | 10363 | cleaver | | | 1 | | | | 10016 | cleaver | 1 | | |
| 10520 | cleaver | 3 | 26 | 11.5 | 10520 | cleaver | | 1 | | | | | 10520 | cleaver | 1 | | |
| 10521 | cleaver | 0 | 24 | 0.0 | 10521 | cleaver | | 1 | | | | | 2066 | cleaver | 1 | | |
| 153 | core | 1 | 17 | 5.9 | 153 | core | | 1 | | | | | 9520 | core | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9231 | core | 1 | 6 | 16.7 | 9231 | core | | | | 1 | | | 10147 | core | 1 | | |
| 9347 | core | 1 | 9 | 11.1 | 9347 | core | | | 1 | | | | 10039 | core | 1 | | |
| 9385 | core | 4 | 5 | 80.0 | 9385 | core | | 1 | | | | | 153 | core | 1 | | |
| 9448 | core | 0 | 5 | 0.0 | 9448 | core | 1 | | | | | | 9347 | core | 1 | | |
| 9520 | core | 0 | 23 | 0.0 | 9520 | core | | 1 | | | | | 9670 | core | 1 | | |
| 9619 | core | 5 | 22 | 22.7 | 9619 | core | | 1 | | | | | 9385 | core | 1 | | |
| 9670 | core | 4 | 5 | 80.0 | 9670 | core | | 1 | | | | | 9619 | core | | 1 | |
| 10022 | core | 1 | 21 | 4.8 | 10022 | core | | | 1 | | | | 10022 | core | 1 | | |
| 10039 | core | 0 | 24 | 0.0 | 10039 | core | 1 | | | | | | 9448 | core | 1 | | |
| 10042 | core | 0 | 22 | 0.0 | 10042 | core | 1 | | | | | | 10042 | core | | 1 | |
| 10097 | core | 2 | 12 | 16.7 | 10097 | core | | | 1 | | | | 9231 | core | 1 | | |
| 10147 | core | 5 | 14 | 35.7 | 10147 | core | | | 1 | | | | 10097 | core | 1 | | |
| 336 | core chunk | 3 | 8 | 37.5 | 336 | core chunk | | | | 1 | | | 10041 | core chunk | 1 | | |
| 9701 | core chunk | 0 | 5 | 0.0 | 9701 | core chunk | | | 1 | | | | 9701 | core chunk | | 1 | |
| 10041 | core chunk | 2 | 3 | 66.7 | 10041 | core chunk | | 1 | | | | | 336 | core chunk | | 1 | |
| S9460 | core chunk Bipolar? | 2 | 5 | 40.0 | S9460 | core chunk | | | 1 | | | | S9460 | core chunk | | 1 | |
| 9399 | core chunk, bipolar? | 1 | 2 | 50.0 | 9399 | core chunk, bipolar? | | | 1 | | | | 9399 | core chunk, bipolar? | 1 | | |
| 9398 | core chunk/ handaxe tip | 0 | 15 | 0.0 | 9398 | core chunk/ handaxe tip | | | 1 | | | | 9398 | core chunk/ handaxe tip | | 1 | |
| 9611 | cunky flake/scraper | 3 | 11 | 27.3 | 9611 | cunky flake | | | 1 | | | | 9611 | cunky flake | | 1 | |
| 9523 | flake | 5 | 17 | 29.4 | 9523 | flake or handaxe piece | | | 1 | | | | 9523 | flake | | 1 | |
| S341 | flake, bipolar | 0 | 4 | 0.0 | S341 | flake, bipolar | | 1 | | | | | S341 | flake, bipolar | 1 | | |
| 2054 | handaxe | 1 | 7 | 14.3 | 2054 | handaxe | | | 1 | | | | 2054 | handaxe | 1 | | |
| 2373 | handaxe | 10 | 41 | 24.4 | 2373 | handaxe | | | 1 | | | | 2373 | handaxe | 1 | | |
| 9690 | proto biface | 0 | 15 | 0.0 | 9690 | prot biface | | | 1 | | | | 9690 | proto biface | 1 | | |
| | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **n** | | | | **Mean** | **n** | | | | | | | | **n** | | | | |
| **34** | | | | 21.5% | **34** | | 4 | 10 | 17 | 3 | 0 | 0 | **34** | | 23 | 10 | 1 |
| | | | | | | Percentage of sample | 11.8 | 29.4 | 50.0 | 8.8 | 0.0 | 0.0 | | Percentage of sample | 67.6 | 29.4 | 2.9 |

**Table 5: Sterkfontein Acheulean quart raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **W, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S9269 | chunk | 1 | 6 | 16.7 | S9269 | chunk | 1 | 26 | 18.2 | 4.7 | 0.2 | 2.1 | S9269 | chunk | 1 | | |
| S10357 | chunk | 1 | 7 | 14.3 | S10357 | chunk | 2 | 37.9 | 29.3 | 11.1 | 0.2 | 1.8 | S10357 | chunk | 1 | | |
| S6974 | chunk | 2 | 4 | 50.0 | S6974 | chunk | 4 | 39 | 31.7 | 12.4 | 0.3 | 3.2 | S6974 | chunk | 1 | | |
| S393 | chunk | 0 | 7 | 0.0 | S393 | chunk | 2 | 29.6 | 27.4 | 8.1 | 0.2 | 2.5 | S393 | chunk | 1 | | |
| S7154 | chunk | 3 | 7 | 42.9 | S7154 | chunk | 1 | 20.8 | 15.5 | 3.2 | 0.3 | 3.1 | S7154 | chunk | 1 | | |
| S9629 | chunk | 1 | 3 | 33.3 | S9629 | chunk | 2 | 30.6 | 14.6 | 4.5 | 0.4 | 4.5 | S9629 | chunk | 1 | | |
| S9631 | chunk | 1 | 4 | 25.0 | S9631 | chunk | 9 | 16.5 | 17.2 | 2.8 | 3.2 | 31.7 | S9631 | chunk | 1 | | |
| S9532 | chunk | 0 | 8 | 0.0 | S9532 | chunk | 3 | 31.5 | 20.7 | 6.5 | 0.5 | 4.6 | S9532 | chunk | 1 | | |
| S7863 | chunk | 0 | 12 | 0.0 | S7863 | chunk | 12 | 46 | 40.8 | 18.8 | 0.6 | 6.4 | S7863 | chunk | 1 | | |
| S7869 | chunk | 1 | 4 | 25.0 | S7869 | chunk | 8 | 15.7 | 22 | 3.5 | 2.3 | 23.2 | S7869 | chunk | 1 | | |
| S7786 | chunk | 0 | 7 | 0.0 | S7786 | chunk | 1 | 22.7 | 17.5 | 4.0 | 0.3 | 2.5 | S7786 | chunk | 1 | | |
| S9453 | chunk | 2 | 4 | 50.0 | S9453 | chunk | 1 | 25.3 | 15.7 | 4.0 | 0.3 | 2.5 | S9453 | chunk | | 1 | |
| S9537 | chunk | 0 | 8 | 0.0 | S9537 | chunk | 13 | 41.8 | 30.7 | 12.8 | 1.0 | 10.1 | S9537 | chunk | 1 | | |
| S2105 | chunk | 1 | 5 | 20.0 | S2105 | chunk | 4 | 23.6 | 25.7 | 6.1 | 0.7 | 6.6 | S2105 | chunk | 1 | | |
| S7862 | chunk | 0 | 3 | 0.0 | S7862 | chunk | 9 | 26 | 19.8 | 5.1 | 1.7 | 17.5 | S7862 | chunk | 1 | | |
| S9271 | chunk | 1 | 11 | 9.1 | S9271 | chunk | 1 | 24.6 | 19.5 | 4.8 | 0.2 | 2.1 | S9271 | chunk | 1 | | |
| S9307 | chunk | 1 | 9 | 11.1 | S9307 | chunk | 1 | 21.3 | 19.3 | 4.1 | 0.2 | 2.4 | S9307 | chunk | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S9652 | chunk, bipolar? | 1 | 2 | 50.0 | S9652 | chunk, bipolar? | 10 | 14.6 | 17.8 | 2.6 | 3.8 | 38.5 | S9652 | chunk, bipolar? | | 1 | |
| S9408 | chunk, posible tip | 1 | 8 | 12.5 | S9408 | chunk, posible tip | 1 | 18.5 | 11.9 | 2.2 | 0.5 | 4.5 | S9408 | chunk, posible tip | 1 | | |
| 7870 | core | 3 | 35 | 8.6 | 7870 | core | 3 | 76 | 46 | 35.0 | 0.1 | 0.9 | 7870 | core | 1 | | |
| S9677 | core | 0 | 10 | 0.0 | S9677 | core | 1 | 39.5 | 29.7 | 11.7 | 0.1 | 0.9 | S9677 | core | 1 | | |
| S9530 | core | 3 | 11 | 27.3 | S9530 | core | 7 | 51.6 | 37 | 19.1 | 0.4 | 3.7 | S9530 | core | 1 | | |
| S9430 | core | 10 | 19 | 52.6 | S9430 | core | 10 | 49 | 38.7 | 19.0 | 0.5 | 5.3 | S9430 | core | 1 | | |
| S9529 | core | 0 | 6 | 0.0 | S9529 | core | 1 | 34 | 28.8 | 9.8 | 0.1 | 1.0 | S9529 | core | 1 | | |
| S9662 | core | 0 | 16 | 0.0 | S9662 | core | 1 | 63.3 | 56 | 35.4 | 0.0 | 0.3 | S9662 | core | 1 | | |
| s9370 | core | 2 | 10 | 20.0 | s9370 | core | 4 | 57.5 | 64.7 | 37.2 | 0.1 | 1.1 | s9370 | core | 1 | | |
| S1146 | core chunk | 0 | 4 | 0.0 | S1146 | core chunk | 3 | 50 | 32 | 16.0 | 0.2 | 1.9 | S1146 | core chunk | 1 | | |
| S9663 | core chunk | 1 | 4 | 25.0 | S9663 | core chunk | 5 | 41 | 40.4 | 16.6 | 0.3 | 3.0 | S9663 | core chunk | 1 | | |
| S9452 | core chunk, bipolar, retouch | 0 | 14 | 0.0 | S9452 | core chunk, bipolar | 1 | 40 | 24.7 | 9.9 | 0.1 | 1.0 | S9452 | core chunk, bipolar | 1 | | |
| S7022 | core cunk, bip? | 0 | 2 | 0.0 | S7022 | core cunk, bip? | 0 | 20.6 | 23.6 | 4.9 | 0.0 | 0.0 | S7022 | core cunk, bip? | 1 | | |
| S9413 | core, chunk | 1 | 9 | 11.1 | S9413 | core, chunk | 1 | 40 | 34.6 | 13.8 | 0.1 | 0.7 | S9413 | core, chunk | 1 | | |
| S9613 | flake | 2 | 5 | 40.0 | S9613 | flake | 7 | 21.8 | 14.3 | 3.1 | 2.2 | 22.5 | S9613 | flake | | 1 | |
| S9639 | flake in | 0 | 5 | 0.0 | S9639 | flake in | 1 | 12.12 | 17.6 | 2.1 | 0.5 | 4.7 | S9639 | flake in | 1 | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **33** | | | | 16.5% | **33** | | | | | | | 6.6 | **33** | | 30 | 3 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 90.9 | 9.1 | 0.0 |

**Table 6: Sterkfontein Acheulean chert raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **W, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4108 | handaxe | 0 | 25 | 0.0 | 4108 | handaxe | 1 | 118.0 | 71.0 | 83.8 | 0.0 | 0.1 | 4108 | handaxe | | 1 | |
| 2053 | handaxe | 0 | 26 | 0.0 | 2053 | handaxe | 1 | 93.0 | 45.0 | 41.9 | 0.0 | 0.2 | 2053 | hanaxe | | 1 | |
| 759 | flake | 3 | 10 | 30.0 | 759 | flake | 2 | 34.0 | 25.6 | 8.7 | 0.2 | 2.3 | 759 | flake | 1 | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **3** | | | | 10.0% | **3** | | | | | | | 0.9 | **3** | | 1 | 2 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 33.3 | 66.7 | 0.0 |

**Table 7: Swartkrans Oldowan quartzite raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **vf** | **f** | **m** | **c** | **vc** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 652** | chopper core | 6 | 15 | 40.0 | **SWT 652** | chopper core | | | 1 | | | **SWT 652** | chopper core | | 1 | |
| **SWT 588** | core, casual | 0 | 9 | 0.0 | **SWT 795** | chunk | | 1 | | | | **SWT 795** | chunk | 1 | | |
| **SWT 373** | core, flat | 0 | 11 | 0.0 | **SWT 949** | chunk | | | 1 | | | **SWT 949** | chunk | 1 | | |
| **SWK 833** | flake | 0 | 7 | 0.0 | **SWT 998** | chunk | | | 1 | | | **SWT 998** | chunk | 1 | | |
| **SWT 1071** | flake | 0 | 3 | 0.0 | **SWT 588** | core, casual | | | 1 | | | **SWT 588** | core, casual | | 1 | |
| **SWT 688** | flake | 0 | 11 | 0.0 | **SWT 689** | core, casual | | | 1 | | | **SWT 689** | core, casual | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 997** | flake | 0 | 6 | 0.0 | **SWT 527** | core, cent | | 1 | | | | **SWT 527** | core, cent | 1 | | |
| **SWT 153** | retouch | 0 | 26 | 0.0 | **SWT 373** | core, flat | | | | 1 | | **SWT 373** | core, flat | 1 | | |
| **SWT 259** | retouch | 0 | 9 | 0.0 | **SWT 699** | core, flat | | 1 | | | | **SWT 699** | core, flat | 1 | | |
| **SWT 444** | retouch | 0 | 11 | 0.0 | **SWT 1002** | core, frag | | | 1 | | | **SWT 1002** | core, frag | 1 | | |
| **SWT 805** | retouch | 0 | 8 | 0.0 | **SWT 733** | core, frag | | | 1 | | | **SWT 733** | core, frag | | 1 | |
| **SWT 1044** | scraper | 0 | 33 | 0.0 | **SWT 50** | core, p | | | 1 | | | **SWT 50** | core, p | | 1 | |
| **SWT 1134** | scraper | 0 | 21 | 0.0 | **SWT 709** | core, p | | | 1 | | | **SWT 709** | core, p | | 1 | |
| **SWT 553** | retouch | 0 | 9 | 0.0 | **SWT 1025** | core, pi | | | 1 | | | **SWT 1025** | core, pi | 1 | | |
| **SWT 1100** | retouch | 1 | 32 | 3.1 | **SWT 737** | core, pi | | 1 | | | | **SWT 737** | core, pi | | 1 | |
| **SWT 249** | retouch | 1 | 12 | 8.3 | **SWT 650** | core, thrown / casual | | 1 | | | | **SWT 650** | core, thrown / casual | | 1 | |
| **SWT 1050** | retouch | 2 | 19 | 10.5 | **SWT 216** | core,pi | | | 1 | | | **SWT 216** | core,pi | 1 | | |
| **SWT 1002** | core, frag | 1 | 9 | 11.1 | **SWK 833** | flake | | | 1 | | | **SWK 833** | flake | | 1 | |
| **SWT 1101** | flake | 1 | 8 | 12.5 | **SWT 1071** | flake | | | 1 | | | **SWT 1071** | flake | 1 | | |
| **SWT 1015** | scraper | 2 | 16 | 12.5 | **SWT 1101** | flake | | 1 | | | | **SWT 1101** | flake | | 1 | |
| **SWT 603** | scraper | 3 | 19 | 15.8 | **SWT 23** | flake | | 1 | | | | **SWT 23** | flake | | 1 | |
| **SWT 527** | core, cent | 4 | 24 | 16.7 | **SWT 454** | flake | | | 1 | | | **SWT 454** | flake | 1 | | |
| **SWT 709** | core, p | 6 | 30 | 20.0 | **SWT 563** | flake | 1 | | | | | **SWT 563** | flake | | | 1 |
| **SWT 737** | core, pi | 2 | 10 | 20.0 | **SWT 688** | flake | | 1 | | | | **SWT 688** | flake | 1 | | |
| **SWT 1059** | retouch | 8 | 33 | 24.2 | **SWT 843** | flake | | | 1 | | | **SWT 843** | flake | 1 | | |
| **SWT 650** | core, thrown / casual | 2 | 8 | 25.0 | **SWT 970** | flake | | 1 | | | | **SWT 970** | flake | | 1 | |
| **SWT 1025** | core, pi | 7 | 24 | 29.2 | **SWT 997** | flake | | 1 | | | | **SWT 997** | flake | 1 | | |
| **SWT 50** | core, p | 2 | 6 | 33.3 | **SWT** | retouch | | 1 | | | | **SWT 1050** | retouch | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **1050** | | | | | | | | | | | |
| **SWT 23** | flake | 2 | 6 | 33.3 | **SWT 1059** | retouch | | | 1 | | | **SWT 1059** | retouch | 1 | | |
| **SWT 525** | retouch | 3 | 9 | 33.3 | **SWT 1100** | retouch | | | 1 | | | **SWT 1100** | retouch | 1 | | |
| **SWT 529** | retouch | 9 | 24 | 37.5 | **SWT 153** | retouch | | 1 | | | | **SWT 153** | retouch | 1 | | |
| **SWT 733** | core, frag | 4 | 10 | 40.0 | **SWT 249** | retouch | | 1 | | | | **SWT 249** | retouch | 1 | | |
| **SWT 454** | flake | 1 | 2 | 50.0 | **SWT 259** | retouch | | 1 | | | | **SWT 259** | retouch | | 1 | |
| **SWT 563** | flake | 2 | 4 | 50.0 | **SWT 319** | retouch | | 1 | | | | **SWT 319** | retouch | | 1 | |
| **SWT 843** | flake | 1 | 2 | 50.0 | **SWT 444** | retouch | | 1 | | | | **SWT 444** | retouch | 1 | | |
| **SWT 319** | retouch | 4 | 8 | 50.0 | **SWT 529** | retouch | | 1 | | | | **SWT 529** | retouch | 1 | | |
| **SWT 795** | chunk | 6 | 10 | 60.0 | **SWT 805** | retouch | | 1 | | | | **SWT 805** | retouch | | | 1 |
| **SWT 699** | core, flat | 3 | 5 | 60.0 | **SWT 1015** | scraper | | 1 | | | | **SWT 1015** | scraper | 1 | | |
| **SWT 949** | chunk | 2 | 3 | 66.7 | **SWT 1044** | scraper | | 1 | | | | **SWT 1044** | scraper | 1 | | |
| **SWT 689** | core, casual | 2 | 3 | 66.7 | **SWT 1134** | scraper | | | 1 | | | **SWT 1134** | scraper | 1 | | |
| **SWT 970** | flake | 2 | 3 | 66.7 | **SWT 603** | scraper | | 1 | | | | **SWT 603** | scraper | 1 | | |
| **SWT 216** | core,pi | 15 | 17 | 88.2 | **SWT 525** | retouch | | | 1 | | | **SWT 525** | retouch | 1 | | |
| **SWT 998** | chunk | 1 | 1 | 100.0 | **SWT 553** | retouch | | | 1 | | | **SWT 553** | retouch | 1 | | |
| | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **n** | | | | |
| **43** | | | | 26.4% | **43** | | 1 | 21 | 20 | 1 | 0 | **43** | | 28 | 13 | 2 |
| | | | | | | Percentage of sample | 2.33 | 49 | 47 | 2 | 0 | | Percentage of sample | 65.1 | 30.2 | 4.7 |

**Table 8: Swartkrans Oldowan quartz raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| Sn | Tt | Iscar | Dscar | % F | Sn | Tt | f | L, mm | W, mm | a cm2 | f/cm2 | f/10 cm2 | Sn | Tt | N | S | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1012** | chunk | 0 | 3 | 0.0 | **SWT 1012** | chunk | 9 | 13.6 | 6.4 | 0.9 | 10.3 | 103.4 | **SWT 1012** | chunk | | 1 | |
| **SWT 1024** | chunk | 0 | 5 | 0.0 | **SWT 1024** | chunk | 2 | 15.2 | 10 | 1.5 | 1.3 | 13.2 | **SWT 1024** | chunk | 1 | | |
| **SWT 1026** | chunk | 2 | 6 | 33.3 | **SWT 1026** | chunk | 1 | 16.7 | 10.2 | 1.7 | 0.6 | 5.9 | **SWT 1026** | chunk | 1 | | |
| **SWT 1068** | chunk | 1 | 14 | 7.1 | **SWT 1068** | chunk | 4 | 21.7 | 13.5 | 2.9 | 1.4 | 13.7 | **SWT 1068** | chunk | 1 | | |
| **SWT 1074** | chunk | 1 | 6 | 16.7 | **SWT 1074** | chunk | 2 | 19.8 | 11.3 | 2.2 | 0.9 | 8.9 | **SWT 1074** | chunk | 1 | | |
| **SWT 1075/ 6?** | chunk | 0 | 11 | 0.0 | **SWT 1075** | chunk | 1 | 16.7 | 11.8 | 2.0 | 0.5 | 5.1 | **SWT 1075** | chunk | 1 | | |
| **SWT 1095** | chunk | 2 | 4 | 50.0 | **SWT 1095** | chunk | 4 | 22.2 | 15.5 | 3.4 | 1.2 | 11.6 | **SWT 1095** | chunk | 1 | | |
| **SWT 1105** | chunk | 1 | 7 | 14.3 | **SWT 1105** | chunk | 3 | 17.2 | 11.4 | 2.0 | 1.5 | 15.3 | **SWT 1105** | chunk | 1 | | |
| **SWT 1106** | chunk | 5 | 10 | 50.0 | **SWT 1106** | chunk | 2 | 18.8 | 14 | 2.6 | 0.8 | 7.6 | **SWT 1106** | chunk | 1 | | |
| **SWT 1109** | chunk | 0 | 14 | 0.0 | **SWT 1109** | chunk | 4 | 15.7 | 15.7 | 2.5 | 1.6 | 16.2 | **SWT 1109** | chunk | 1 | | |
| **SWT 1164** | chunk | 5 | 8 | 62.5 | **SWT 1164** | chunk | 6 | 28.4 | 15 | 4.3 | 1.4 | 14.1 | **SWT 1164** | chunk | 1 | | |
| **SWT 251** | chunk | 2 | 3 | 66.7 | **SWT 251** | chunk | 6 | 33 | 18.3 | 6.0 | 1.0 | 9.9 | **SWT 251** | chunk | | 1 | |
| **SWT 264** | chunk | 0 | 15 | 0.0 | **SWT 264** | chunk | 1 | 17 | 13 | 2.2 | 0.5 | 4.5 | **SWT 264** | chunk | 1 | | |
| **SWT 308** | chunk | 1 | 7 | 14.3 | **SWT 308** | chunk | 5 | 21.4 | 20.1 | 4.3 | 1.2 | 11.6 | **SWT 308** | chunk | | 1 | |
| **SWT 463** | chunk | 1 | 7 | 14.3 | **SWT 463** | chunk | 2 | 28.1 | 16.6 | 4.7 | 0.4 | 4.3 | **SWT 463** | chunk | 1 | | |
| **SWT 710** | chunk | 5 | 17 | 29.4 | **SWT 710** | chunk | 3 | 26 | 15.3 | 4.0 | 0.8 | 7.5 | **SWT 710** | chunk | 1 | | |
| **SWT 755** | chunk | 5 | 5 | 100.0 | **SWT 755** | chunk | 2 | 19.7 | 17.2 | 3.4 | 0.6 | 5.9 | **SWT 755** | chunk | 1 | | |
| **SWT 876** | chunk | 5 | 5 | 100.0 | **SWT 876** | chunk | 4 | 15 | 13.2 | 2.0 | 2.0 | 20.2 | **SWT 876** | chunk | | 1 | |
| **SWT 881** | chunk | 3 | 3 | 100.0 | **SWT 881** | chunk | 2 | 17 | 12.5 | 2.1 | 0.9 | 9.4 | **SWT 881** | chunk | | 1 | |
| **SWT 922** | chunk | 1 | 7 | 14.3 | **SWT 922** | chunk | 5 | 18 | 13.8 | 2.5 | 2.0 | 20.1 | **SWT 922** | chunk | 1 | | |
| **SWT 946** | chunk | 0 | 6 | 0.0 | **SWT 946** | chunk | 2 | 18.2 | 10.4 | 1.9 | 1.1 | 10.6 | **SWT 946** | chunk | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 952** | chunk | 1 | 12 | 8.3 | **SWT 952** | chunk | 8 | 35 | 25.2 | 8.8 | 0.9 | 9.1 | **SWT 952** | chunk | | 1 | |
| **SWT 979** | chunk | 5 | 12 | 41.7 | **SWT 979** | chunk | 4 | 25.6 | 13.6 | 3.5 | 1.1 | 11.5 | **SWT 979** | chunk | | 1 | |
| **SWT 1096** | Chunk | 0 | 2 | 0.0 | **SWT 1096** | Chunk | 1 | 39.8 | 29.1 | 11.6 | 0.1 | 0.9 | **SWT 1096** | Chunk | 1 | | |
| **SWT 612** | Chunk | 3 | 3 | 100.0 | **SWT 612** | Chunk | 6 | 39.4 | 20 | 7.9 | 0.8 | 7.6 | **SWT 612** | Chunk | | 1 | |
| **SWT 104** | Chunk | 1 | 1 | 100.0 | **SWT 104** | Chunk | 3 | 17 | 11.4 | 1.9 | 1.5 | 15.5 | **SWT 104** | Chunk | 1 | | |
| **SWT 787** | Chunk | 1 | 2 | 50.0 | **SWT 787** | Chunk | 1 | 24.2 | 16.3 | 3.9 | 0.3 | 2.5 | **SWT 787** | Chunk | 1 | | |
| **SWT 975** | chunk | 1 | 3 | 33.3 | **SWT 975** | chunk | 5 | 15.2 | 11 | 1.7 | 3.0 | 29.9 | **SWT 975** | chunk | | 1 | |
| **SWT 827** | chunk | 1 | 1 | 100.0 | **SWT 827** | chunk | 11 | 21.3 | 12.6 | 2.7 | 4.1 | 41.0 | **SWT 827** | chunk | | 1 | |
| **SWT 604** | chunk | 2 | 3 | 66.7 | **SWT 604** | chunk | 5 | 27.5 | 14.7 | 4.0 | 1.2 | 12.4 | **SWT 604** | chunk | 1 | | |
| **SWT 607** | chunk | 1 | 4 | 25.0 | **SWT 607** | chunk | 1 | 10.1 | 8.5 | 0.9 | 1.2 | 11.6 | **SWT 607** | chunk | 1 | | |
| **SWT 628** | Chunk | 1 | 1 | 100.0 | **SWT 628** | Chunk | 3 | 16.3 | 11.7 | 1.9 | 1.6 | 15.7 | **SWT 628** | Chunk | 1 | | |
| **SWT 645** | chunk | 0 | 6 | 0.0 | **SWT 645** | chunk | 1 | 15.7 | 14.7 | 2.3 | 0.4 | 4.3 | **SWT 645** | chunk | 1 | | |
| **SWT 751** | chunk | 3 | 3 | 100.0 | **SWT 751** | chunk | 8 | 21 | 15.9 | 3.3 | 2.4 | 24.0 | **SWT 751** | chunk | 1 | | |
| **SWT 453** | Chunk | 0 | 5 | 0.0 | **SWT 453** | Chunk | 4 | 13.4 | 12.2 | 1.6 | 2.4 | 24.5 | **SWT 453** | Chunk | 1 | | |
| **SWT 284** | chunk | 2 | 2 | 100.0 | **SWT 284** | chunk | 5 | 21.4 | 6.4 | 1.4 | 3.7 | 36.5 | **SWT 284** | chunk | | 1 | |
| **SWT 248** | chunk bip | 1 | 3 | 33.3 | **SWT 248** | chunk bip | 13 | 22.8 | 19.7 | 4.5 | 2.9 | 28.9 | **SWT 248** | chunk bip | 1 | | |
| **SWT 37** | chunk, bip | 2 | 2 | 100.0 | **SWT 37** | chunk, bip | 6 | 22 | 15 | 3.3 | 1.8 | 18.2 | **SWT 37** | chunk, bip | 1 | | |
| **SWT 269** | chunk. Bip | 5 | 8 | 62.5 | **SWT 269** | chunk | 2 | 37.8 | 18 | 6.8 | 0.3 | 2.9 | **SWT 269** | chunk | | 1 | |
| **SWT 1010** | core, bip | 0 | 15 | 0.0 | **SWT 1010** | core, bip | 4 | 33.1 | 30.1 | 10.0 | 0.4 | 4.0 | **SWT 1010** | core, bip | 1 | | |
| **SWT 275** | core, bip | 4 | 7 | 57.1 | **SWT 275** | core, bip | 4 | 36 | 28.7 | 10.3 | 0.4 | 3.9 | **SWT 275** | core, bip | 1 | | |
| **SWT 279** | core, bip | 1 | 9 | 11.1 | **SWT 279** | core, bip | 10 | 24 | 18.2 | 4.4 | 2.3 | 22.9 | **SWT 279** | core, bip | 1 | | |
| **SWT 347** | core, bip | 1 | 12 | 8.3 | **SWT 347** | core, bip | 1 | 26.2 | 15 | 3.9 | 0.3 | 2.5 | **SWT 347** | core, bip | 1 | | |
| **SWT1035** | core, bip | 3 | 15 | 20.0 | **SWT1035** | core, bip | 2 | 22.5 | 17 | 3.8 | 0.5 | 5.2 | **SWT1035** | core, bip | 1 | | |
| **SWT 692** | core, bip | 0 | 2 | 0.0 | **SWT 692** | core, bip | 4 | 17.8 | 16.8 | 3.0 | 1.3 | 13.4 | **SWT 692** | core, bip | 1 | | |
| **SWT 286** | core, bip | 3 | 10 | 30.0 | **SWT 286** | core, bip | 7 | 18.1 | 11.3 | 2.0 | 3.4 | 34.2 | **SWT 286** | core, bip | | 1 | |
| **SWT 978** | core, bip frag | 0 | 11 | 0.0 | **SWT 978** | core, bip frag | 3 | 34.1 | 30.3 | 10.3 | 0.3 | 2.9 | **SWT 978** | core, bip frag | 1 | | |
| **SWT 789** | Core, cas | 1 | 1 | 100.0 | **SWT 789** | Core, cas | 2 | 23.5 | 13.2 | 3.1 | 0.6 | 6.4 | **SWT 789** | Core, cas | 1 | | |
| **SWT 1031** | core, casual | 0 | 2 | 0.0 | **SWT 1031** | core, casual | 0 | 14 | 18.3 | 2.6 | 0.0 | 0.0 | **SWT 1031** | core, casual | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 735** | core, casual | 1 | 1 | 100.0 | **SWT 735** | core, casual | 4 | 32 | 28.9 | 9.2 | 0.4 | 4.3 | **SWT 735** | core, casual | | 1 | |
| **SWT 771** | core, casual | 8 | 10 | 80.0 | **SWT 771** | core, casual | 10 | 11 | 11 | 1.2 | 8.3 | 82.6 | **SWT 771** | core, casual | | 1 | |
| **SWT 951** | core, casual | 4 | 9 | 44.4 | **SWT 951** | core, casual | 7 | 26 | 24.3 | 6.3 | 1.1 | 11.1 | **SWT 951** | core, casual | | 1 | |
| **SWT 11** | core, cent | 6 | 11 | 54.5 | **SWT 11** | core, cent | 12 | 47 | 38 | 17.9 | 0.7 | 6.7 | **SWT 11** | core, cent | 1 | | |
| **SWT 121** | core, cent | 3 | 25 | 12.0 | **SWT 121** | core, cent | 3 | 50.3 | 47 | 23.6 | 0.1 | 1.3 | **SWT 121** | core, cent | 1 | | |
| **SWT 392** | core, cent | 6 | 37 | 16.2 | **SWT 392** | core, cent | 21 | 20 | 18.7 | 3.7 | 5.6 | 56.1 | **SWT 392** | core, cent | 1 | | |
| **SWT 4** | core, cent | 6 | 10 | 60.0 | **SWT 4** | core, cent | 2 | 26 | 23.2 | 6.0 | 0.3 | 3.3 | **SWT 4** | core, cent | 1 | | |
| **SWT 792** | core, cent | 1 | 10 | 10.0 | **SWT 792** | core, cent | 2 | 43.9 | 28.9 | 12.7 | 0.2 | 1.6 | **SWT 792** | core, cent | 1 | | |
| **SWT 911** | core, cent | 1 | 21 | 4.8 | **SWT 911** | core, cent | 2 | 60 | 34 | 20.4 | 0.1 | 1.0 | **SWT 911** | core, cent | 1 | | |
| **SWT 815** | core, chunk | 2 | 4 | 50.0 | **SWT 815** | core, chunk | 4 | 32 | 24.4 | 7.8 | 0.5 | 5.1 | **SWT 815** | core, chunk | 1 | | |
| **SWT 558** | core, chunk | 4 | 4 | 100.0 | **SWT 558** | core, chunk | 9 | 25.13 | 17.7 | 4.4 | 2.0 | 20.2 | **SWT 558** | core, chunk | | 1 | |
| **SWT 1058** | core, chunk, bip | 2 | 4 | 50.0 | **SWT 1058** | core, chunk | 15 | 36.5 | 29.3 | 10.7 | 1.4 | 14.0 | **SWT 1058** | core, chunk | 1 | | |
| **SWT 1023** | core, pi | 2 | 11 | 18.2 | **SWT 1023** | core, pi | 1 | 65 | 39 | 25.4 | 0.0 | 0.4 | **SWT 1023** | core, pi | 1 | | |
| **SWT 1063** | core, pi | 2 | 26 | 7.7 | **SWT 1063** | core, pi | 13 | 29.4 | 14.1 | 4.1 | 3.1 | 31.4 | **SWT 1063** | core, pi | 1 | | |
| **SWT 1080** | core, pi | 5 | 6 | 83.3 | **SWT 1080** | core, pi | 5 | 36.2 | 31 | 11.2 | 0.4 | 4.5 | **SWT 1080** | core, pi | | 1 | |
| **SWT 250** | core, pi | 8 | 27 | 29.6 | **SWT 250** | core, pi | 4 | 28.4 | 27.5 | 7.8 | 0.5 | 5.1 | **SWT 250** | core, pi | 1 | | |
| **SWT 376** | core, pi | 4 | 20 | 20.0 | **SWT 376** | core, pi | 11 | 18.8 | 9.7 | 1.8 | 6.0 | 60.3 | **SWT 376** | core, pi | | 1 | |
| **SWT 387** | core, pi | 3 | 12 | 25.0 | **SWT 387** | core, pi | 2 | 45 | 36.6 | 16.5 | 0.1 | 1.2 | **SWT 387** | core, pi | 1 | | |
| **SWT 53** | core, pi | 6 | 10 | 60.0 | **SWT 53** | core, pi | 4 | 50 | 33 | 16.5 | 0.2 | 2.4 | **SWT 53** | core, pi | | 1 | |
| **SWT 557** | core, pi | 7 | 12 | 58.3 | **SWT 557** | core, pi | 14 | 20.2 | 13.2 | 2.7 | 5.3 | 52.5 | **SWT 557** | core, pi | 1 | | |
| **SWT 642** | core, pi | 7 | 10 | 70.0 | **SWT 642** | core, pi | 4 | 41.6 | 33.5 | 13.9 | 0.3 | 2.9 | **SWT 642** | core, pi | 1 | | |
| **SWT 865** | core, pi | 4 | 18 | 22.2 | **SWT 865** | core, pi | 4 | 48.6 | 40.8 | 19.8 | 0.2 | 2.0 | **SWT 865** | core, pi | 1 | | |
| **SWT 704** | core, split | 1 | 1 | 100.0 | **SWT 704** | core, split | 8 | 36.6 | 29.5 | 10.8 | 0.7 | 7.4 | **SWT 704** | core, split | 1 | | |
| **SWT 717** | core, split, bip | 1 | 2 | 50.0 | **SWT 717** | core, split, bip | 5 | 22.3 | 23.7 | 5.3 | 0.9 | 9.5 | **SWT 717** | core, split, bip | | 1 | |
| **SWT 995** | core. Bip | 2 | 5 | 40.0 | **SWT 995** | core. Bip | 13 | 36.9 | 22.6 | 8.3 | 1.6 | 15.6 | **SWT 995** | core. Bip | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1057** | denticulate | 0 | 15 | 0.0 | **SWT 1057** | denticulate | 3 | 31 | 14 | 4.3 | 0.7 | 6.9 | **SWT 1057** | denticulate | 1 | | |
| **SWT 1** | flake | 1 | 5 | 20.0 | **SWT 1** | flake | 1 | 38 | 19.8 | 7.5 | 0.1 | 1.3 | **SWT 1** | flake | 1 | | |
| **SWT 101** | flake | 0 | 8 | 0.0 | **SWT 101** | flake | 12 | 20.3 | 14.7 | 3.0 | 4.0 | 40.2 | **SWT 101** | flake | 1 | | |
| **SWT 1017** | flake | 3 | 3 | 100.0 | **SWT 1017** | flake | 20 | 42.4 | 23 | 9.8 | 2.1 | 20.5 | **SWT 1017** | flake | | 1 | |
| **SWT 1021** | flake | 0 | 1 | 0.0 | **SWT 1021** | flake | 1 | 20.8 | 18.1 | 3.8 | 0.3 | 2.7 | **SWT 1021** | flake | 1 | | |
| **SWT 1053** | flake | 2 | 4 | 50.0 | **SWT 1053** | flake | 4 | 21.7 | 15.7 | 3.4 | 1.2 | 11.7 | **SWT 1053** | flake | | 1 | |
| **SWT 1056** | flake | 2 | 6 | 33.3 | **SWT 1056** | flake | 1 | 21 | 17 | 3.6 | 0.3 | 2.8 | **SWT 1056** | flake | | 1 | |
| **SWT 1066** | flake | 3 | 5 | 60.0 | **SWT 1066** | flake | 3 | 22.6 | 20.6 | 4.7 | 0.6 | 6.4 | **SWT 1066** | flake | | 1 | |
| **SWT 107** | flake | 3 | 3 | 100.0 | **SWT 107** | flake | 13 | 20.8 | 11.4 | 2.4 | 5.5 | 54.8 | **SWT 107** | flake | | 1 | |
| **SWT 1070** | flake | 2 | 5 | 40.0 | **SWT 1070** | flake | 1 | 37.5 | 34.4 | 12.9 | 0.1 | 0.8 | **SWT 1070** | flake | | 1 | |
| **SWT 1073** | flake | 2 | 2 | 100.0 | **SWT 1073** | flake | 7 | 12.8 | 9.8 | 1.3 | 5.6 | 55.8 | **SWT 1073** | flake | | 1 | |
| **SWT 1077** | flake | 0 | 3 | 0.0 | **SWT 1077** | flake | 13 | 7.7 | 8.7 | 0.7 | 19.4 | 194.1 | **SWT 1077** | flake | | 1 | |
| **SWT 1081** | flake | 1 | 1 | 100.0 | **SWT 1081** | flake | 3 | 28.2 | 22 | 6.2 | 0.5 | 4.8 | **SWT 1081** | flake | 1 | | |
| **SWT 1087** | flake | 2 | 3 | 66.7 | **SWT 1087** | flake | 5 | 19.6 | 18.4 | 3.6 | 1.4 | 13.9 | **SWT 1087** | flake | 1 | | |
| **SWT 1116** | flake | 0 | 3 | 0.0 | **SWT 1116** | flake | 0 | 23 | 7.4 | 1.7 | 0.0 | 0.0 | **SWT 1116** | flake | 1 | | |
| **SWT 1130** | flake | 5 | 14 | 35.7 | **SWT 1130** | flake | 2 | 36.7 | 28.8 | 10.6 | 0.2 | 1.9 | **SWT 1130** | flake | 1 | | |
| **SWT 1160** | flake | 1 | 4 | 25.0 | **SWT 1160** | flake | 1 | 26.8 | 14.7 | 3.9 | 0.3 | 2.5 | **SWT 1160** | flake | 1 | | |
| **SWT 1175** | flake | 6 | 7 | 85.7 | **SWT 1175** | flake | 4 | 30.4 | 12.5 | 3.8 | 1.1 | 10.5 | **SWT 1175** | flake | | 1 | |
| **SWT 1178** | flake | 2 | 9 | 22.2 | **SWT 1178** | flake | 3 | 18.4 | 13.2 | 2.4 | 1.2 | 12.4 | **SWT 1178** | flake | 1 | | |
| **SWT 1200** | flake | 0 | 4 | 0.0 | **SWT 1200** | flake | 5 | 19.5 | 16.3 | 3.2 | 1.6 | 15.7 | **SWT 1200** | flake | | 1 | |
| **SWT 14** | flake | 2 | 6 | 33.3 | **SWT 14** | flake | 3 | 18.5 | 16.7 | 3.1 | 1.0 | 9.7 | **SWT 14** | flake | 1 | | |
| **SWT 155** | flake | 1 | 4 | 25.0 | **SWT 155** | flake | 1 | 19.3 | 13.2 | 2.5 | 0.4 | 3.9 | **SWT 155** | flake | 1 | | |
| **SWT 159** | flake | 3 | 5 | 60.0 | **SWT 159** | flake | 8 | 22 | 18 | 4.0 | 2.0 | 20.2 | **SWT 159** | flake | | 1 | |
| **SWT 16** | flake | 3 | 13 | 23.1 | **SWT 16** | flake | 4 | 29.5 | 21.8 | 6.4 | 0.6 | 6.2 | **SWT 16** | flake | 1 | | |
| **SWT 177** | flake | 4 | 4 | 100.0 | **SWT 177** | flake | 3 | 16.8 | 15 | 2.5 | 1.2 | 11.9 | **SWT 177** | flake | | 1 | |
| **SWT 22** | flake | 1 | 6 | 16.7 | **SWT 22** | flake | 1 | 15.8 | 14.3 | 2.3 | 0.4 | 4.4 | **SWT 22** | flake | 1 | | |
| **SWT 220** | flake | 2 | 4 | 50.0 | **SWT 220** | flake | 5 | 24.6 | 10 | 2.5 | 2.0 | 20.3 | **SWT 220** | flake | | 1 | |
| **SWT 257** | flake | 2 | 8 | 25.0 | **SWT 257** | flake | 6 | 46.7 | 23.7 | 11.1 | 0.5 | 5.4 | **SWT 257** | flake | 1 | | |
| **SWT 277** | flake | 4 | 8 | 50.0 | **SWT 277** | flake | 2 | 17.4 | 11.3 | 2.0 | 1.0 | 10.2 | **SWT 277** | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 280** | flake | 0 | 9 | 0.0 | **SWT 280** | flake | 0 | 24.2 | 9.6 | 2.3 | 0.0 | 0.0 | **SWT 280** | flake | 1 | |
| **SWT 289** | flake | 0 | 1 | 0.0 | **SWT 289** | flake | 0 | 18.4 | 18.2 | 3.3 | 0.0 | 0.0 | **SWT 289** | flake | 1 | |
| **SWT 292** | flake | 1 | 4 | 25.0 | **SWT 292** | flake | 2 | 16 | 11.1 | 1.8 | 1.1 | 11.3 | **SWT 292** | flake | | 1 |
| **SWT 293** | flake | 1 | 1 | 100.0 | **SWT 293** | flake | 3 | 18.6 | 14.1 | 2.6 | 1.1 | 11.4 | **SWT 293** | flake | | 1 |
| **SWT 294** | flake | 1 | 6 | 16.7 | **SWT 294** | flake | 1 | 18.7 | 10.2 | 1.9 | 0.5 | 5.2 | **SWT 294** | flake | 1 | |
| **SWT 3** | flake | 2 | 4 | 50.0 | **SWT 3** | flake | 4 | 19.7 | 17.1 | 3.4 | 1.2 | 11.9 | **SWT 3** | flake | | 1 |
| **SWT 30** | flake | 3 | 5 | 60.0 | **SWT 30** | flake | 10 | 39.7 | 21 | 8.3 | 1.2 | 12.0 | **SWT 30** | flake | | 1 |
| **SWT 31** | flake | 1 | 4 | 25.0 | **SWT 31** | flake | 5 | 34.2 | 25.8 | 8.8 | 0.6 | 5.7 | **SWT 31** | flake | | 1 |
| **SWT 310** | flake | 0 | 7 | 0.0 | **SWT 310** | flake | 3 | 18 | 10.7 | 1.9 | 1.6 | 15.6 | **SWT 310** | flake | 1 | |
| **SWT 313** | flake | 3 | 18 | 16.7 | **SWT 313** | flake | 8 | 38.4 | 31.5 | 12.1 | 0.7 | 6.6 | **SWT 313** | flake | 1 | |
| **SWT 33** | flake | 0 | 1 | 0.0 | **SWT 33** | flake | 1 | 19.2 | 14.5 | 2.8 | 0.4 | 3.6 | **SWT 33** | flake | 1 | |
| **SWT 372** | flake | 1 | 8 | 12.5 | **SWT 372** | flake | 1 | 16.8 | 10.1 | 1.7 | 0.6 | 5.9 | **SWT 372** | flake | 1 | |
| **SWT 39** | flake | 0 | 10 | 0.0 | **SWT 39** | flake | 1 | 22 | 11.2 | 2.5 | 0.4 | 4.1 | **SWT 39** | flake | 1 | |
| **SWT 41** | flake | 2 | 7 | 28.6 | **SWT 41** | flake | 9 | 19 | 13.7 | 2.6 | 3.5 | 34.6 | **SWT 41** | flake | | 1 |
| **SWT 435** | flake | 0 | 4 | 0.0 | **SWT 435** | flake | 1 | 18.3 | 8.2 | 1.5 | 0.7 | 6.7 | **SWT 435** | flake | 1 | |
| **SWT 44** | flake | 1 | 6 | 16.7 | **SWT 44** | flake | 3 | 36 | 18.5 | 6.7 | 0.5 | 4.5 | **SWT 44** | flake | 1 | |
| **SWT 468** | flake | 3 | 6 | 50.0 | **SWT 468** | flake | 4 | 17.6 | 12.4 | 2.2 | 1.8 | 18.3 | **SWT 468** | flake | | 1 |
| **SWT 503** | flake | 4 | 7 | 57.1 | **SWT 503** | flake | 20 | 24.8 | 22.5 | 5.6 | 3.6 | 35.8 | **SWT 503** | flake | | 1 |
| **SWT 507** | flake | 2 | 3 | 66.7 | **SWT 507** | flake | 19 | 16.7 | 12.8 | 2.1 | 8.9 | 88.9 | **SWT 507** | flake | | 1 |
| **SWT 510** | flake | 1 | 6 | 16.7 | **SWT 510** | flake | 15 | 23 | 24.8 | 5.7 | 2.6 | 26.3 | **SWT 510** | flake | 1 | |
| **SWT 560** | flake | 5 | 13 | 38.5 | **SWT 560** | flake | 2 | 18.7 | 10 | 1.9 | 1.1 | 10.7 | **SWT 560** | flake | 1 | |
| **SWT 562** | flake | 2 | 3 | 66.7 | **SWT 562** | flake | 2 | 14.6 | 12.8 | 1.9 | 1.1 | 10.7 | **SWT 562** | flake | 1 | |
| **SWT 587** | flake | 1 | 2 | 50.0 | **SWT 587** | flake | 8 | 25 | 14 | 3.5 | 2.3 | 22.9 | **SWT 587** | flake | | 1 |
| **SWT 609** | flake | 2 | 2 | 100.0 | **SWT 609** | flake | 19 | 22.3 | 13 | 2.9 | 6.6 | 65.5 | **SWT 609** | flake | 1 | |
| **SWT 63** | flake | 2 | 13 | 15.4 | **SWT 63** | flake | 3 | 22 | 14.5 | 3.2 | 0.9 | 9.4 | **SWT 63** | flake | 1 | |
| **SWT 665** | flake | 1 | 4 | 25.0 | **SWT 665** | flake | 4 | 21.2 | 15.3 | 3.2 | 1.2 | 12.3 | **SWT 665** | flake | 1 | |
| **SWT 682** | flake | 1 | 4 | 25.0 | **SWT 682** | flake | 3 | 15.7 | 11.3 | 1.8 | 1.7 | 16.9 | **SWT 682** | flake | 1 | |
| **SWT 684** | flake | 2 | 7 | 28.6 | **SWT 684** | flake | 1 | 19 | 15.8 | 3.0 | 0.3 | 3.3 | **SWT 684** | flake | 1 | |
| **SWT 698** | flake | 3 | 3 | 100.0 | **SWT 698** | flake | 2 | 22.4 | 13 | 2.9 | 0.7 | 6.9 | **SWT 698** | flake | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 702** | flake | 6 | 6 | 100.0 | **SWT 702** | flake | 4 | 37.5 | 16.1 | 6.0 | 0.7 | 6.6 | **SWT 702** | flake | 1 | | |
| **SWT 71** | flake | 1 | 2 | 50.0 | **SWT 71** | flake | 4 | 23 | 14.2 | 3.3 | 1.2 | 12.2 | **SWT 71** | flake | | 1 | |
| **SWT 714** | flake | 5 | 7 | 71.4 | **SWT 714** | flake | 4 | 17.4 | 11.7 | 2.0 | 2.0 | 19.6 | **SWT 714** | flake | 1 | | |
| **SWT 73** | flake | 2 | 5 | 40.0 | **SWT 73** | flake | 4 | 33.2 | 29.8 | 9.9 | 0.4 | 4.0 | **SWT 73** | flake | 1 | | |
| **SWT 731** | flake | 0 | 8 | 0.0 | **SWT 731** | flake | 3 | 22.5 | 13.5 | 3.0 | 1.0 | 9.9 | **SWT 731** | flake | 1 | | |
| **SWT 74** | flake | 4 | 7 | 57.1 | **SWT 74** | flake | 8 | 32.5 | 23.7 | 7.7 | 1.0 | 10.4 | **SWT 74** | flake | | 1 | |
| **SWT 753** | flake | 0 | 16 | 0.0 | **SWT 753** | flake | 12 | 34 | 21 | 7.1 | 1.7 | 16.8 | **SWT 753** | flake | 1 | | |
| **SWT 758** | flake | 4 | 4 | 100.0 | **SWT 758** | flake | 6 | 12.4 | 8.7 | 1.1 | 5.6 | 55.6 | **SWT 758** | flake | | 1 | |
| **SWT 774** | flake | 1 | 7 | 14.3 | **SWT 774** | flake | 2 | 16.8 | 15 | 2.5 | 0.8 | 7.9 | **SWT 774** | flake | 1 | | |
| **SWT 776** | flake | 5 | 7 | 71.4 | **SWT 776** | flake | 2 | 17.5 | 11.1 | 1.9 | 1.0 | 10.3 | **SWT 776** | flake | 1 | | |
| **SWT 804** | flake | 0 | 4 | 0.0 | **SWT 804** | flake | 1 | 17.7 | 9.9 | 1.8 | 0.6 | 5.7 | **SWT 804** | flake | | 1 | |
| **SWT 838** | flake | 4 | 4 | 100.0 | **SWT 838** | flake | 3 | 25.8 | 20.2 | 5.2 | 0.6 | 5.8 | **SWT 838** | flake | | 1 | |
| **SWT 839** | flake | 1 | 1 | 100.0 | **SWT 839** | flake | 1 | 17.6 | 13 | 2.3 | 0.4 | 4.4 | **SWT 839** | flake | 1 | | |
| **SWT 850** | flake | 2 | 8 | 25.0 | **SWT 850** | flake | 1 | 20.3 | 18.4 | 3.7 | 0.3 | 2.7 | **SWT 850** | flake | 1 | | |
| **SWT 853** | flake | 1 | 4 | 25.0 | **SWT 853** | flake | 2 | 21 | 15.8 | 3.3 | 0.6 | 6.0 | **SWT 853** | flake | | 1 | |
| **SWT 854** | flake | 2 | 8 | 25.0 | **SWT 854** | flake | 3 | 23.7 | 21.1 | 5.0 | 0.6 | 6.0 | **SWT 854** | flake | 1 | | |
| **SWT 856** | flake | 0 | 5 | 0.0 | **SWT 856** | flake | 1 | 17.6 | 17.2 | 3.0 | 0.3 | 3.3 | **SWT 856** | flake | 1 | | |
| **SWT 858** | flake | 0 | 1 | 0.0 | **SWT 858** | flake | 0 | 30.6 | 11.2 | 3.4 | 0.0 | 0.0 | **SWT 858** | flake | 1 | | |
| **SWT 884** | flake | 2 | 3 | 66.7 | **SWT 884** | flake | 1 | 25.7 | 13.7 | 3.5 | 0.3 | 2.8 | **SWT 884** | flake | | 1 | |
| **SWT 89** | flake | 3 | 16 | 18.8 | **SWT 89** | flake | 4 | 18.3 | 12.4 | 2.3 | 1.8 | 17.6 | **SWT 89** | flake | 1 | | |
| **SWT 929** | flake | 0 | 7 | 0.0 | **SWT 929** | flake | 3 | 17 | 13.9 | 2.4 | 1.3 | 12.7 | **SWT 929** | flake | 1 | | |
| **SWT 932** | flake | 0 | 6 | 0.0 | **SWT 932** | flake | 1 | 18.1 | 16 | 2.9 | 0.3 | 3.5 | **SWT 932** | flake | 1 | | |
| **SWT 936** | flake | 1 | 1 | 100.0 | **SWT 936** | flake | 6 | 24 | 16 | 3.8 | 1.6 | 15.6 | **SWT 936** | flake | | 1 | |
| **SWT 954** | flake | 2 | 10 | 20.0 | **SWT 954** | flake | 3 | 20.2 | 16.0 | 3.2 | 0.9 | 9.3 | **SWT 954** | flake | | 1 | |
| **SWT 958** | flake | 1 | 1 | 100.0 | **SWT 958** | flake | 2 | 24.2 | 13.5 | 3.3 | 0.6 | 6.1 | **SWT 958** | flake | | 1 | |
| **SWT 963** | flake | 0 | 9 | 0.0 | **SWT 963** | flake | 2 | 20.7 | 7.3 | 1.5 | 1.3 | 13.2 | **SWT 963** | flake | 1 | | |
| **SWT 965** | flake | 2 | 5 | 40.0 | **SWT 965** | flake | 1 | 22.2 | 9.7 | 2.2 | 0.5 | 4.6 | **SWT 965** | flake | 1 | | |
| **SWT 967** | flake | 0 | 6 | 0.0 | **SWT 967** | flake | 15 | 21 | 18.7 | 3.9 | 3.8 | 38.2 | **SWT 967** | flake | 1 | | |
| **SWT 969** | flake | 3 | 7 | 42.9 | **SWT 969** | flake | 6 | 10 | 10 | 1.0 | 6.0 | 60.0 | **SWT 969** | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 97** | flake | 0 | 3 | 0.0 | **SWT 97** | flake | 1 | 14.6 | 7.4 | 1.1 | 0.9 | 9.3 | **SWT 97** | flake | 1 | | |
| **SWT 973** | flake | 0 | 11 | 0.0 | **SWT 973** | flake | 1 | 21 | 18.2 | 3.8 | 0.3 | 2.6 | **SWT 973** | flake | 1 | | |
| **SWT 980** | flake | 2 | 5 | 40.0 | **SWT 980** | flake | 3 | 23.2 | 18.7 | 4.3 | 0.7 | 6.9 | **SWT 980** | flake | | 1 | |
| **SWT 982** | flake | 2 | 11 | 18.2 | **SWT 982** | flake | 1 | 18 | 16.5 | 3.0 | 0.3 | 3.4 | **SWT 982** | flake | 1 | | |
| **SWT 983** | flake | 3 | 6 | 50.0 | **SWT 983** | flake | 5 | 20.5 | 18.2 | 3.7 | 1.3 | 13.4 | **SWT 983** | flake | | 1 | |
| **SWT 984** | flake | 3 | 4 | 75.0 | **SWT 984** | flake | 3 | 21.7 | 13.8 | 3.0 | 1.0 | 10.0 | **SWT 984** | flake | 1 | | |
| **SWT 985** | flake | 1 | 1 | 100.0 | **SWT 985** | flake | 3 | 14.2 | 12 | 1.7 | 1.8 | 17.6 | **SWT 985** | flake | | 1 | |
| **SWT 991** | flake | 2 | 5 | 40.0 | **SWT 991** | flake | 0 | 21.7 | 7 | 1.5 | 0.0 | 0.0 | **SWT 991** | flake | 1 | | |
| **SWT 992** | flake | 1 | 4 | 25.0 | **SWT 992** | flake | 2 | 20.5 | 11.2 | 2.3 | 0.9 | 8.7 | **SWT 992** | flake | | 1 | |
| **SWT 10** | Flake | 0 | 1 | 0.0 | **SWT 10** | Flake | 3 | 24 | 10.1 | 2.4 | 1.2 | 12.4 | **SWT 10** | Flake | 1 | | |
| **SWT 135** | Flake | 0 | 5 | 0.0 | **SWT 135** | Flake | 1 | 15.6 | 14.9 | 2.3 | 0.4 | 4.3 | **SWT 135** | Flake | 1 | | |
| **SWT 520** | Flake | 1 | 6 | 16.7 | **SWT 520** | Flake | 0 | 22 | 14 | 3.1 | 0.0 | 0.0 | **SWT 520** | Flake | 1 | | |
| **SWT 48** | Flake | 0 | 1 | 0.0 | **SWT 48** | Flake | 3 | 22.7 | 15.6 | 3.5 | 0.8 | 8.5 | **SWT 48** | Flake | 1 | | |
| **SWT 62** | Flake | 1 | 1 | 100.0 | **SWT 62** | Flake | 5 | 23.5 | 17.1 | 4.0 | 1.2 | 12.4 | **SWT 62** | Flake | 1 | | |
| **SWT 498** | Flake | 2 | 2 | 100.0 | **SWT 498** | Flake | 2 | 18.3 | 15 | 2.7 | 0.7 | 7.3 | **SWT 498** | Flake | 1 | | |
| **SWT 905** | Flake | 1 | 3 | 33.3 | **SWT 905** | Flake | 2 | 13 | 9.6 | 1.2 | 1.6 | 16.0 | **SWT 905** | Flake | 1 | | |
| **SWT 1104** | Flake | 0 | 1 | 0.0 | **SWT 1104** | Flake | 5 | 16.4 | 15.6 | 2.6 | 2.0 | 19.5 | **SWT 1104** | Flake | 1 | | |
| **SWT 643** | Flake | 1 | 2 | 50.0 | **SWT 643** | Flake | 5 | 29.4 | 17.4 | 5.1 | 1.0 | 9.8 | **SWT 643** | Flake | 1 | | |
| **SWT 655** | Flake | 1 | 1 | 100.0 | **SWT 655** | Flake | 6 | 21.3 | 15.6 | 3.3 | 1.8 | 18.1 | **SWT 655** | Flake | 1 | | |
| **SWT 663** | Flake | 2 | 2 | 100.0 | **SWT 663** | Flake | 9 | 35.2 | 8.7 | 3.1 | 2.9 | 29.4 | **SWT 663** | Flake | 1 | | |
| **SWT 816** | Flake | 2 | 3 | 66.7 | **SWT 816** | Flake | 2 | 20.2 | 19.4 | 3.9 | 0.5 | 5.1 | **SWT 816** | Flake | 1 | | |
| **SWT 136** | Flake | 0 | 4 | 0.0 | **SWT 136** | Flake | 3 | 18.3 | 11.7 | 2.1 | 1.4 | 14.0 | **SWT 136** | Flake | 1 | | |
| **SWT 619** | Flake | 0 | 1 | 0.0 | **SWT 619** | Flake | 2 | 21.3 | 13 | 2.8 | 0.7 | 7.2 | **SWT 619** | Flake | 1 | | |
| **SWT 644** | Flake | 1 | 6 | 16.7 | **SWT 644** | Flake | 3 | 21.4 | 15.1 | 3.2 | 0.9 | 9.3 | **SWT 644** | Flake | 1 | | |
| **SWT 819** | Flake | 2 | 2 | 100.0 | **SWT 819** | Flake | 3 | 19.3 | 8.7 | 1.7 | 1.8 | 17.9 | **SWT 819** | Flake | 1 | | |
| **SWT 1035** | Flake | 2 | 6 | 33.3 | **SWT 1035** | Flake | 3 | 19.6 | 16.3 | 3.2 | 0.9 | 9.4 | **SWT 1035** | Flake | 1 | | |
| **SWT 772** | Flake | 1 | 1 | 100.0 | **SWT 772** | Flake | 1 | 15.7 | 13.4 | 2.1 | 0.5 | 4.8 | **SWT 772** | Flake | 1 | | |
| **SWT 140** | Flake | 0 | 4 | 0.0 | **SWT 140** | Flake | 1 | 14.2 | 13 | 1.8 | 0.5 | 5.4 | **SWT 140** | Flake | 1 | | |
| **SWT 978** | Flake | 0 | 4 | 0.0 | **SWT 978** | Flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | **SWT 978** | Flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1007** | retouch | 1 | 12 | 8.3 | **SWT 1007** | retouch | 0 | 18.7 | 5.3 | 1.0 | 0.0 | 0.0 | **SWT 1007** | retouch | 1 | | |
| **SWT 1008** | retouch | 1 | 15 | 6.7 | **SWT 1008** | retouch | 5 | 25 | 25 | 6.3 | 0.8 | 8.0 | **SWT 1008** | retouch | 1 | | |
| **SWT 1009** | retouch | 2 | 10 | 20.0 | **SWT 1009** | retouch | 10 | 27.5 | 25.3 | 7.0 | 1.4 | 14.4 | **SWT 1009** | retouch | | 1 | |
| **SWT 103** | retouch | 0 | 17 | 0.0 | **SWT 103** | retouch | 2 | 21.6 | 12.8 | 2.8 | 0.7 | 7.2 | **SWT 103** | retouch | 1 | | |
| **SWT 1030** | retouch | 0 | 11 | 0.0 | **SWT 1030** | retouch | 1 | 21.6 | 7.3 | 1.6 | 0.6 | 6.3 | **SWT 1030** | retouch | 1 | | |
| **SWT 1032** | retouch | 2 | 19 | 10.5 | **SWT 1032** | retouch | 2 | 24.5 | 14.4 | 3.5 | 0.6 | 5.7 | **SWT 1032** | retouch | 1 | | |
| **SWT 1037** | retouch | 4 | 17 | 23.5 | **SWT 1037** | retouch | 14 | 27.5 | 23.4 | 6.4 | 2.2 | 21.8 | **SWT 1037** | retouch | | 1 | |
| **SWT 1039** | retouch | 0 | 6 | 0.0 | **SWT 1039** | retouch | 1 | 20 | 15.8 | 3.2 | 0.3 | 3.2 | **SWT 1039** | retouch | 1 | | |
| **SWT 1047** | retouch | 0 | 14 | 0.0 | **SWT 1047** | retouch | 3 | 30.2 | 17 | 5.1 | 0.6 | 5.8 | **SWT 1047** | retouch | 1 | | |
| **SWT 1048** | retouch | 2 | 6 | 33.3 | **SWT 1048** | retouch | 2 | 22 | 16.4 | 3.6 | 0.6 | 5.5 | **SWT 1048** | retouch | | 1 | |
| **SWT 1049** | retouch | 0 | 21 | 0.0 | **SWT 1049** | retouch | 1 | 23.5 | 19.5 | 4.6 | 0.2 | 2.2 | **SWT 1049** | retouch | 1 | | |
| **SWT 1054** | retouch | 2 | 12 | 16.7 | **SWT 1054** | retouch | 2 | 21 | 19.7 | 4.1 | 0.5 | 4.8 | **SWT 1054** | retouch | 1 | | |
| **SWT 1055** | retouch | 1 | 15 | 6.7 | **SWT 1055** | retouch | 1 | 22.6 | 16 | 3.6 | 0.3 | 2.8 | **SWT 1055** | retouch | 1 | | |
| **SWT 1065** | retouch | 0 | 5 | 0.0 | **SWT 1065** | retouch | 1 | 29.4 | 9 | 2.6 | 0.4 | 3.8 | **SWT 1065** | retouch | 1 | | |
| **SWT 1075** | retouch | 0 | 10 | 0.0 | **SWT 1075** | retouch | 1 | 20 | 10.8 | 2.2 | 0.5 | 4.6 | **SWT 1075** | retouch | 1 | | |
| **SWT 1079** | retouch | 1 | 15 | 6.7 | **SWT 1079** | retouch | 3 | 33.3 | 18.2 | 6.1 | 0.5 | 5.0 | **SWT 1079** | retouch | 1 | | |
| **SWT 108** | retouch | 4 | 11 | 36.4 | **SWT 108** | retouch | 2 | 25.3 | 17.3 | 4.4 | 0.5 | 4.6 | **SWT 108** | retouch | 1 | | |
| **SWT 1084** | retouch | 0 | 19 | 0.0 | **SWT 1084** | retouch | 2 | 18 | 12.3 | 2.2 | 0.9 | 9.0 | **SWT 1084** | retouch | 1 | | |
| **SWT 1088** | retouch | 1 | 26 | 3.8 | **SWT 1088** | retouch | 15 | 21 | 10.8 | 2.3 | 6.6 | 66.1 | **SWT 1088** | retouch | 1 | | |
| **SWT 1090** | retouch | 1 | 5 | 20.0 | **SWT 1090** | retouch | 11 | 15.3 | 15 | 2.3 | 4.8 | 47.9 | **SWT 1090** | retouch | 1 | | |
| **SWT 1091** | retouch | 6 | 11 | 54.5 | **SWT 1091** | retouch | 3 | 28 | 20.7 | 5.8 | 0.5 | 5.2 | **SWT 1091** | retouch | | 1 | |
| **SWT 1094** | retouch | 4 | 18 | 22.2 | **SWT 1094** | retouch | 3 | 21.5 | 15.7 | 3.4 | 0.9 | 8.9 | **SWT 1094** | retouch | 1 | | |
| **SWT 1097** | retouch | 2 | 13 | 15.4 | **SWT 1097** | retouch | 1 | 19.3 | 12.4 | 2.4 | 0.4 | 4.2 | **SWT 1097** | retouch | 1 | | |
| **SWT 1099** | retouch | 3 | 12 | 25.0 | **SWT 1099** | retouch | 2 | 19.7 | 12.7 | 2.5 | 0.8 | 8.0 | **SWT 1099** | retouch | 1 | | |
| **SWT 1110** | retouch | 2 | 7 | 28.6 | **SWT 1110** | retouch | 0 | 15 | 12.4 | 1.9 | 0.0 | 0.0 | **SWT 1110** | retouch | 1 | | |
| **SWT 1113** | retouch | 0 | 16 | 0.0 | **SWT 1113** | retouch | 3 | 26.7 | 13.5 | 3.6 | 0.8 | 8.3 | **SWT 1113** | retouch | 1 | | |
| **SWT 1120** | retouch | 6 | 12 | 50.0 | **SWT 1120** | retouch | 2 | 28.7 | 16.7 | 4.8 | 0.4 | 4.2 | **SWT 1120** | retouch | 1 | | |
| **SWT 1132** | retouch | 1 | 1 | 100.0 | **SWT 1132** | retouch | 3 | 18.4 | 18.3 | 3.4 | 0.9 | 8.9 | **SWT 1132** | retouch | 1 | | |
| **SWT 1135** | retouch | 1 | 3 | 33.3 | **SWT 1135** | retouch | 2 | 24 | 20.5 | 4.9 | 0.4 | 4.1 | **SWT 1135** | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1146** | retouch | 2 | 9 | 22.2 | **SWT 1146** | retouch | 1 | 16.8 | 12.3 | 2.1 | 0.5 | 4.8 | **SWT 1146** | retouch | | 1 | |
| **SWT 115** | retouch | 0 | 14 | 0.0 | **SWT 115** | retouch | 1 | 18 | 15 | 2.7 | 0.4 | 3.7 | **SWT 115** | retouch | 1 | | |
| **SWT 1154** | retouch | 2 | 17 | 11.8 | **SWT 1154** | retouch | 2 | 27 | 10.3 | 2.8 | 0.7 | 7.2 | **SWT 1154** | retouch | 1 | | |
| **SWT 1155** | retouch | 0 | 7 | 0.0 | **SWT 1155** | retouch | 3 | 18.6 | 13 | 2.4 | 1.2 | 12.4 | **SWT 1155** | retouch | 1 | | |
| **SWT 1156** | retouch | 2 | 10 | 20.0 | **SWT 1156** | retouch | 14 | 27 | 14.4 | 3.9 | 3.6 | 36.0 | **SWT 1156** | retouch | 1 | | |
| **SWT 1172** | retouch | 1 | 9 | 11.1 | **SWT 1172** | retouch | 5 | 24.6 | 14.6 | 3.6 | 1.4 | 13.9 | **SWT 1172** | retouch | | 1 | |
| **SWT 1173** | retouch | 1 | 10 | 10.0 | **SWT 1173** | retouch | 3 | 18.8 | 14.7 | 2.8 | 1.1 | 10.9 | **SWT 1173** | retouch | 1 | | |
| **SWT 1180** | retouch | 10 | 15 | 66.7 | **SWT 1180** | retouch | 2 | 36.5 | 25 | 9.1 | 0.2 | 2.2 | **SWT 1180** | retouch | 1 | | |
| **SWT 1181** | retouch | 0 | 19 | 0.0 | **SWT 1181** | retouch | 1 | 25 | 18 | 4.5 | 0.2 | 2.2 | **SWT 1181** | retouch | 1 | | |
| **SWT 12** | retouch | 2 | 16 | 12.5 | **SWT 12** | retouch | 4 | 28 | 17.5 | 4.9 | 0.8 | 8.2 | **SWT 12** | retouch | | 1 | |
| **SWT 124** | retouch | 9 | 21 | 42.9 | **SWT 124** | retouch | 4 | 48.2 | 35.4 | 17.1 | 0.2 | 2.3 | **SWT 124** | retouch | | 1 | |
| **SWT 125** | retouch | 5 | 20 | 25.0 | **SWT 125** | retouch | 5 | 40 | 18.7 | 7.5 | 0.7 | 6.7 | **SWT 125** | retouch | 1 | | |
| **SWT 126** | retouch | 5 | 17 | 29.4 | **SWT 126** | retouch | 2 | 42 | 30.3 | 12.7 | 0.2 | 1.6 | **SWT 126** | retouch | | 1 | |
| **SWT 179** | retouch | 4 | 14 | 28.6 | **SWT 179** | retouch | 36 | 78 | 50.5 | 39.4 | 0.9 | 9.1 | **SWT 179** | retouch | 1 | | |
| **SWT 18** | retouch | 3 | 11 | 27.3 | **SWT 18** | retouch | 1 | 39.8 | 28 | 11.1 | 0.1 | 0.9 | **SWT 18** | retouch | 1 | | |
| **SWT 182** | retouch | 0 | 5 | 0.0 | **SWT 182** | retouch | 17 | 16.7 | 12 | 2.0 | 8.5 | 84.8 | **SWT 182** | retouch | 1 | | |
| **SWT 187** | retouch | 0 | 17 | 0.0 | **SWT 187** | retouch | 0 | 16.3 | 10.4 | 1.7 | 0.0 | 0.0 | **SWT 187** | retouch | 1 | | |
| **SWT 2** | retouch | 1 | 8 | 12.5 | **SWT 2** | retouch | 14 | 15 | 15 | 2.3 | 6.2 | 62.2 | **SWT 2** | retouch | | 1 | |
| **SWT 20** | retouch | 0 | 30 | 0.0 | **SWT 20** | retouch | 0 | 31.5 | 16 | 5.0 | 0.0 | 0.0 | **SWT 20** | retouch | 1 | | |
| **SWT 21** | retouch | 1 | 10 | 10.0 | **SWT 21** | retouch | 1 | 18.5 | 16.5 | 3.1 | 0.3 | 3.3 | **SWT 21** | retouch | 1 | | |
| **SWT 210** | retouch | 14 | 22 | 63.6 | **SWT 210** | retouch | 3 | 34.4 | 29.5 | 10.1 | 0.3 | 3.0 | **SWT 210** | retouch | | 1 | |
| **SWT 213** | retouch | 7 | 31 | 22.6 | **SWT 213** | retouch | 1 | 18.6 | 15.8 | 2.9 | 0.3 | 3.4 | **SWT 213** | retouch | 1 | | |
| **SWT 219** | retouch | 0 | 10 | 0.0 | **SWT 219** | retouch | 13 | 9 | 8.8 | 0.8 | 16.4 | 164.1 | **SWT 219** | retouch | 1 | | |
| **SWT 252** | retouch | 0 | 11 | 0.0 | **SWT 252** | retouch | 0 | 20.4 | 13.7 | 2.8 | 0.0 | 0.0 | **SWT 252** | retouch | 1 | | |
| **SWT 253** | retouch | 0 | 11 | 0.0 | **SWT 253** | retouch | 1 | 19 | 12.2 | 2.3 | 0.4 | 4.3 | **SWT 253** | retouch | 1 | | |
| **SWT 256** | retouch | 9 | 27 | 33.3 | **SWT 256** | retouch | 5 | 37.2 | 28.6 | 10.6 | 0.5 | 4.7 | **SWT 256** | retouch | | 1 | |
| **SWT 260** | retouch | 4 | 8 | 50.0 | **SWT 260** | retouch | 3 | 19 | 15 | 2.9 | 1.1 | 10.5 | **SWT 260** | retouch | | 1 | |
| **SWT 267** | retouch | 5 | 23 | 21.7 | **SWT 267** | retouch | 6 | 29.2 | 15 | 4.4 | 1.4 | 13.7 | **SWT 267** | retouch | | 1 | |
| **SWT 271** | retouch | 1 | 19 | 5.3 | **SWT 271** | retouch | 1 | 22 | 20 | 4.4 | 0.2 | 2.3 | **SWT 271** | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 276** | retouch | 0 | 12 | 0.0 | **SWT 276** | retouch | 0 | 16.2 | 14.4 | 2.3 | 0.0 | 0.0 | **SWT 276** | retouch | 1 | | |
| **SWT 282** | retouch | 4 | 14 | 28.6 | **SWT 282** | retouch | 3 | 25 | 16.8 | 4.2 | 0.7 | 7.1 | **SWT 282** | retouch | | 1 | |
| **SWT 285** | retouch | 0 | 15 | 0.0 | **SWT 285** | retouch | 9 | 20.4 | 8 | 1.6 | 5.5 | 55.1 | **SWT 285** | retouch | | 1 | |
| **SWT 291** | retouch | 1 | 8 | 12.5 | **SWT 291** | retouch | 4 | 26.4 | 17 | 4.5 | 0.9 | 8.9 | **SWT 291** | retouch | | 1 | |
| **SWT 297** | retouch | 1 | 9 | 11.1 | **SWT 297** | retouch | 3 | 22.8 | 10.4 | 2.4 | 1.3 | 12.7 | **SWT 297** | retouch | | 1 | |
| **SWT 309** | retouch | 3 | 8 | 37.5 | **SWT 309** | retouch | 4 | 18.5 | 16.7 | 3.1 | 1.3 | 12.9 | **SWT 309** | retouch | 1 | | |
| **SWT 311** | retouch | 2 | 23 | 8.7 | **SWT 311** | retouch | 0 | 20 | 11.1 | 2.2 | 0.0 | 0.0 | **SWT 311** | retouch | 1 | | |
| **SWT 314** | retouch | 0 | 15 | 0.0 | **SWT 314** | retouch | 2 | 27 | 24.3 | 6.6 | 0.3 | 3.0 | **SWT 314** | retouch | 1 | | |
| **SWT 318** | retouch | 7 | 11 | 63.6 | **SWT 318** | retouch | 8 | 12.7 | 10.8 | 1.4 | 5.8 | 58.3 | **SWT 318** | retouch | | 1 | |
| **SWT 34** | retouch | 5 | 13 | 38.5 | **SWT 34** | retouch | 2 | 22.4 | 10.3 | 2.3 | 0.9 | 8.7 | **SWT 34** | retouch | 1 | | |
| **SWT 345** | retouch | 2 | 16 | 12.5 | **SWT 345** | retouch | 2 | 25.8 | 16.8 | 4.3 | 0.5 | 4.6 | **SWT 345** | retouch | 1 | | |
| **SWT 346** | retouch | 2 | 11 | 18.2 | **SWT 346** | retouch | 1 | 20.4 | 8.6 | 1.8 | 0.6 | 5.7 | **SWT 346** | retouch | 1 | | |
| **SWT 348** | retouch | 4 | 15 | 26.7 | **SWT 348** | retouch | 4 | 32.2 | 19 | 6.1 | 0.7 | 6.5 | **SWT 348** | retouch | | 1 | |
| **SWT 349** | retouch | 3 | 20 | 15.0 | **SWT 349** | retouch | 2 | 18.5 | 15.3 | 2.8 | 0.7 | 7.1 | **SWT 349** | retouch | 1 | | |
| **SWT 35** | retouch | 0 | 15 | 0.0 | **SWT 35** | retouch | 8 | 25 | 5.2 | 1.3 | 6.2 | 61.5 | **SWT 35** | retouch | 1 | | |
| **SWT 350** | retouch | 0 | 13 | 0.0 | **SWT 350** | retouch | 1 | 22.2 | 21 | 4.7 | 0.2 | 2.1 | **SWT 350** | retouch | 1 | | |
| **SWT 359** | retouch | 0 | 7 | 0.0 | **SWT 359** | retouch | 1 | 18 | 10 | 1.8 | 0.6 | 5.6 | **SWT 359** | retouch | 1 | | |
| **SWT 36** | retouch | 3 | 10 | 30.0 | **SWT 36** | retouch | 1 | 29 | 17 | 4.9 | 0.2 | 2.0 | **SWT 36** | retouch | 1 | | |
| **SWT 371** | retouch | 4 | 10 | 40.0 | **SWT 371** | retouch | 6 | 31.6 | 23.8 | 7.5 | 0.8 | 8.0 | **SWT 371** | retouch | | 1 | |
| **SWT 38** | retouch | 2 | 7 | 28.6 | **SWT 38** | retouch | 2 | 17.2 | 12.1 | 2.1 | 1.0 | 9.6 | **SWT 38** | retouch | 1 | | |
| **SWT 380** | retouch | 3 | 8 | 37.5 | **SWT 380** | retouch | 3 | 22.7 | 17 | 3.9 | 0.8 | 7.8 | **SWT 380** | retouch | | 1 | |
| **SWT 388** | retouch | 0 | 11 | 0.0 | **SWT 388** | retouch | 5 | 20.7 | 13 | 2.7 | 1.9 | 18.6 | **SWT 388** | retouch | 1 | | |
| **SWT 390** | retouch | 0 | 16 | 0.0 | **SWT 390** | retouch | 0 | 15.6 | 9.1 | 1.4 | 0.0 | 0.0 | **SWT 390** | retouch | 1 | | |
| **SWT 393** | retouch | 1 | 27 | 3.7 | **SWT 393** | retouch | 1 | 25.8 | 20 | 5.2 | 0.2 | 1.9 | **SWT 393** | retouch | 1 | | |
| **SWT 398** | retouch | 3 | 11 | 27.3 | **SWT 398** | retouch | 9 | 16 | 15 | 2.4 | 3.8 | 37.5 | **SWT 398** | retouch | | 1 | |
| **SWT 399** | retouch | 0 | 13 | 0.0 | **SWT 399** | retouch | 0 | 23.4 | 9.4 | 2.2 | 0.0 | 0.0 | **SWT 399** | retouch | 1 | | |
| **SWT 40** | retouch | 1 | 9 | 11.1 | **SWT 40** | retouch | 1 | 21.4 | 12.3 | 2.6 | 0.4 | 3.8 | **SWT 40** | retouch | 1 | | |
| **SWT 403** | retouch | 5 | 10 | 50.0 | **SWT 403** | retouch | 6 | 31.6 | 22 | 7.0 | 0.9 | 8.6 | **SWT 403** | retouch | | 1 | |
| **SWT 404** | retouch | 1 | 19 | 5.3 | **SWT 404** | retouch | 8 | 30 | 23 | 6.9 | 1.2 | 11.6 | **SWT 404** | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 411** | retouch | 1 | 15 | 6.7 | **SWT 411** | retouch | 4 | 41.1 | 23 | 9.5 | 0.4 | 4.2 | **SWT 411** | retouch | 1 | | |
| **SWT 412** | retouch | 0 | 7 | 0.0 | **SWT 412** | retouch | 0 | 15.5 | 15.3 | 2.4 | 0.0 | 0.0 | **SWT 412** | retouch | 1 | | |
| **SWT 42** | retouch | 3 | 16 | 18.8 | **SWT 42** | retouch | 4 | 29.4 | 17 | 5.0 | 0.8 | 8.0 | **SWT 42** | retouch | 1 | | |
| **SWT 421** | retouch | 1 | 8 | 12.5 | **SWT 421** | retouch | 3 | 17.2 | 13.7 | 2.4 | 1.3 | 12.7 | **SWT 421** | retouch | 1 | | |
| **SWT 423** | retouch | 9 | 9 | 100.0 | **SWT 423** | retouch | 0 | 19.7 | 15 | 3.0 | 0.0 | 0.0 | **SWT 423** | retouch | 1 | | |
| **SWT 43** | retouch | 2 | 26 | 7.7 | **SWT 43** | retouch | 3 | 31.5 | 20.5 | 6.5 | 0.5 | 4.6 | **SWT 43** | retouch | 1 | | |
| **SWT 434** | retouch | 0 | 25 | 0.0 | **SWT 434** | retouch | 6 | 29 | 16.1 | 4.7 | 1.3 | 12.9 | **SWT 434** | retouch | 1 | | |
| **SWT 436** | retouch | 3 | 9 | 33.3 | **SWT 436** | retouch | 3 | 16.5 | 14 | 2.3 | 1.3 | 13.0 | **SWT 436** | retouch | 1 | | |
| **SWT 437** | retouch | 3 | 11 | 27.3 | **SWT 437** | retouch | 7 | 24.7 | 22.3 | 5.5 | 1.3 | 12.7 | **SWT 437** | retouch | 1 | | |
| **SWT 438** | retouch | 6 | 17 | 35.3 | **SWT 438** | retouch | 5 | 30.7 | 24.7 | 7.6 | 0.7 | 6.6 | **SWT 438** | retouch | | 1 | |
| **SWT 442** | retouch | 1 | 4 | 25.0 | **SWT 442** | retouch | 0 | 16 | 9 | 1.4 | 0.0 | 0.0 | **SWT 442** | retouch | 1 | | |
| **SWT 446** | retouch | 0 | 24 | 0.0 | **SWT 446** | retouch | 4 | 30 | 15.8 | 4.7 | 0.8 | 8.4 | **SWT 446** | retouch | 1 | | |
| **SWT 473** | retouch | 5 | 10 | 50.0 | **SWT 473** | retouch | 2 | 34.6 | 18.4 | 6.4 | 0.3 | 3.1 | **SWT 473** | retouch | 1 | | |
| **SWT 474** | retouch | 2 | 11 | 18.2 | **SWT 474** | retouch | 3 | 18.9 | 17.5 | 3.3 | 0.9 | 9.1 | **SWT 474** | retouch | 1 | | |
| **SWT 5** | retouch | 3 | 16 | 18.8 | **SWT 5** | retouch | 6 | 29 | 17 | 4.9 | 1.2 | 12.2 | **SWT 5** | retouch | 1 | | |
| **SWT 506** | retouch | 2 | 8 | 25.0 | **SWT 506** | retouch | 3 | 26.5 | 11.2 | 3.0 | 1.0 | 10.1 | **SWT 506** | retouch | 1 | | |
| **SWT 532** | retouch | 2 | 15 | 13.3 | **SWT 532** | retouch | 2 | 25.8 | 21.2 | 5.5 | 0.4 | 3.7 | **SWT 532** | retouch | 1 | | |
| **SWT 535** | retouch | 2 | 10 | 20.0 | **SWT 535** | retouch | 18 | 19.6 | 15.1 | 3.0 | 6.1 | 60.8 | **SWT 535** | retouch | | 1 | |
| **SWT 556** | retouch | 1 | 6 | 16.7 | **SWT 556** | retouch | 19 | 25.6 | 14.5 | 3.7 | 5.1 | 51.2 | **SWT 556** | retouch | | 1 | |
| **SWT 559** | retouch | 3 | 11 | 27.3 | **SWT 559** | retouch | 11 | 22.3 | 18.3 | 4.1 | 2.7 | 27.0 | **SWT 559** | retouch | 1 | | |
| **SWT 564** | retouch | 2 | 17 | 11.8 | **SWT 564** | retouch | 7 | 26.8 | 22 | 5.9 | 1.2 | 11.9 | **SWT 564** | retouch | 1 | | |
| **SWT 6** | retouch | 0 | 16 | 0.0 | **SWT 6** | retouch | 1 | 23.7 | 11.2 | 2.7 | 0.4 | 3.8 | **SWT 6** | retouch | 1 | | |
| **SWT 604** | retouch | 6 | 19 | 31.6 | **SWT 604** | retouch | 6 | 38.1 | 26.1 | 9.9 | 0.6 | 6.0 | **SWT 604** | retouch | 1 | | |
| **SWT 610** | retouch | 1 | 19 | 5.3 | **SWT 610** | retouch | 7 | 25.7 | 18 | 4.6 | 1.5 | 15.1 | **SWT 610** | retouch | | 1 | |
| **SWT 630** | retouch | 0 | 15 | 0.0 | **SWT 630** | retouch | 3 | 23.2 | 14 | 3.2 | 0.9 | 9.2 | **SWT 630** | retouch | 1 | | |
| **SWT 64** | retouch | 0 | 20 | 0.0 | **SWT 64** | retouch | 1 | 26.5 | 15 | 4.0 | 0.3 | 2.5 | **SWT 64** | retouch | 1 | | |
| **SWT 65** | retouch | 1 | 7 | 14.3 | **SWT 65** | retouch | 16 | 17.2 | 15.2 | 2.6 | 6.1 | 61.2 | **SWT 65** | retouch | | 1 | |
| **SWT 675** | retouch | 1 | 6 | 16.7 | **SWT 675** | retouch | 3 | 20.4 | 15.5 | 3.2 | 0.9 | 9.5 | **SWT 675** | retouch | 1 | | |
| **SWT 687** | retouch | 3 | 11 | 27.3 | **SWT 687** | retouch | 3 | 15 | 14 | 2.1 | 1.4 | 14.3 | **SWT 687** | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 701** | retouch | 4 | 16 | 25.0 | **SWT 701** | retouch | 1 | 24 | 19 | 4.6 | 0.2 | 2.2 | **SWT 701** | retouch | 1 | | |
| **SWT 726** | retouch | 2 | 10 | 20.0 | **SWT 726** | retouch | 2 | 20.8 | 16.3 | 3.4 | 0.6 | 5.9 | **SWT 726** | retouch | 1 | | |
| **SWT 728** | retouch | 0 | 6 | 0.0 | **SWT 728** | retouch | 3 | 18.7 | 13.2 | 2.5 | 1.2 | 12.2 | **SWT 728** | retouch | 1 | | |
| **SWT 748** | retouch | 2 | 5 | 40.0 | **SWT 748** | retouch | 1 | 15.2 | 12.8 | 1.9 | 0.5 | 5.1 | **SWT 748** | retouch | 1 | | |
| **SWT 75** | retouch | 6 | 23 | 26.1 | **SWT 75** | retouch | 11 | 36 | 15.6 | 5.6 | 2.0 | 19.6 | **SWT 75** | retouch | | 1 | |
| **SWT 752** | retouch | 0 | 12 | 0.0 | **SWT 752** | retouch | 2 | 27.5 | 17 | 4.7 | 0.4 | 4.3 | **SWT 752** | retouch | 1 | | |
| **SWT 76** | retouch | 0 | 20 | 0.0 | **SWT 76** | retouch | 20 | 32.4 | 22.6 | 7.3 | 2.7 | 27.3 | **SWT 76** | retouch | 1 | | |
| **SWT 769** | retouch | 4 | 8 | 50.0 | **SWT 769** | retouch | 4 | 31.3 | 18.6 | 5.8 | 0.7 | 6.9 | **SWT 769** | retouch | | 1 | |
| **SWT 773** | retouch | 3 | 21 | 14.3 | **SWT 773** | retouch | 5 | 35.1 | 27.8 | 9.8 | 0.5 | 5.1 | **SWT 773** | retouch | 1 | | |
| **SWT 78** | retouch | 0 | 16 | 0.0 | **SWT 78** | retouch | 3 | 29 | 11.3 | 3.3 | 0.9 | 9.2 | **SWT 78** | retouch | 1 | | |
| **SWT 801** | retouch | 4 | 15 | 26.7 | **SWT 801** | retouch | 6 | 32 | 21.6 | 6.9 | 0.9 | 8.7 | **SWT 801** | retouch | | 1 | |
| **SWT 802** | retouch | 4 | 11 | 36.4 | **SWT 802** | retouch | 1 | 24.5 | 11.5 | 2.8 | 0.4 | 3.5 | **SWT 802** | retouch | 1 | | |
| **SWT 826** | retouch | 2 | 15 | 13.3 | **SWT 826** | retouch | 1 | 24.2 | 9.8 | 2.4 | 0.4 | 4.2 | **SWT 826** | retouch | 1 | | |
| **SWT 829** | retouch | 3 | 11 | 27.3 | **SWT 829** | retouch | 3 | 21.3 | 20 | 4.3 | 0.7 | 7.0 | **SWT 829** | retouch | | 1 | |
| **SWT 832** | retouch | 1 | 5 | 20.0 | **SWT 832** | retouch | 2 | 20.2 | 16.2 | 3.3 | 0.6 | 6.1 | **SWT 832** | retouch | | 1 | |
| **SWT 840** | retouch | 0 | 11 | 0.0 | **SWT 840** | retouch | 0 | 20 | 9.6 | 1.9 | 0.0 | 0.0 | **SWT 840** | retouch | 1 | | |
| **SWT 848** | retouch | 1 | 15 | 6.7 | **SWT 848** | retouch | 0 | 13.7 | 9.5 | 1.3 | 0.0 | 0.0 | **SWT 848** | retouch | 1 | | |
| **SWT 849** | retouch | 1 | 16 | 6.3 | **SWT 849** | retouch | 2 | 22.6 | 15.5 | 3.5 | 0.6 | 5.7 | **SWT 849** | retouch | 1 | | |
| **SWT 85** | retouch | 2 | 5 | 40.0 | **SWT 85** | retouch | 2 | 29.5 | 17.6 | 5.2 | 0.4 | 3.9 | **SWT 85** | retouch | 1 | | |
| **SWT 859** | retouch | 2 | 16 | 12.5 | **SWT 859** | retouch | 7 | 41 | 29 | 11.9 | 0.6 | 5.9 | **SWT 859** | retouch | 1 | | |
| **SWT 869** | retouch | 4 | 7 | 57.1 | **SWT 869** | retouch | 1 | 25 | 14 | 3.5 | 0.3 | 2.9 | **SWT 869** | retouch | | 1 | |
| **SWT 872** | retouch | 6 | 16 | 37.5 | **SWT 872** | retouch | 1 | 24 | 20 | 4.8 | 0.2 | 2.1 | **SWT 872** | retouch | 1 | | |
| **SWT 874** | retouch | 3 | 30 | 10.0 | **SWT 874** | retouch | 17 | 55.5 | 44.2 | 24.5 | 0.7 | 6.9 | **SWT 874** | retouch | 1 | | |
| **SWT 885** | retouch | 4 | 18 | 22.2 | **SWT 885** | retouch | 10 | 29.3 | 18.5 | 5.4 | 1.8 | 18.4 | **SWT 885** | retouch | 1 | | |
| **SWT 898** | retouch | 2 | 12 | 16.7 | **SWT 898** | retouch | 1 | 24 | 14.3 | 3.4 | 0.3 | 2.9 | **SWT 898** | retouch | 1 | | |
| **SWT 90** | retouch | 8 | 32 | 25.0 | **SWT 90** | retouch | 6 | 44.2 | 39.8 | 17.6 | 0.3 | 3.4 | **SWT 90** | retouch | 1 | | |
| **SWT 907** | retouch | 2 | 15 | 13.3 | **SWT 907** | retouch | 0 | 16.7 | 11.6 | 1.9 | 0.0 | 0.0 | **SWT 907** | retouch | 1 | | |
| **SWT 924** | retouch | 1 | 13 | 7.7 | **SWT 924** | retouch | 2 | 21 | 13.5 | 2.8 | 0.7 | 7.1 | **SWT 924** | retouch | 1 | | |
| **SWT 930** | retouch | 2 | 25 | 8.0 | **SWT 930** | retouch | 1 | 20.7 | 19.6 | 4.1 | 0.2 | 2.5 | **SWT 930** | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 950** | retouch | 2 | 20 | 10.0 | **SWT 950** | retouch | 3 | 19.3 | 8.7 | 1.7 | 1.8 | 17.9 | **SWT 950** | retouch | 1 | | |
| **SWT 955** | retouch | 2 | 11 | 18.2 | **SWT 955** | retouch | 3 | 37.5 | 28.7 | 10.8 | 0.3 | 2.8 | **SWT 955** | retouch | | 1 | |
| **SWT 96** | retouch | 1 | 13 | 7.7 | **SWT 96** | retouch | 2 | 24.5 | 13.2 | 3.2 | 0.6 | 6.2 | **SWT 96** | retouch | 1 | | |
| **SWT 964** | retouch | 1 | 14 | 7.1 | **SWT 964** | retouch | 2 | 18.5 | 15 | 2.8 | 0.7 | 7.2 | **SWT 964** | retouch | 1 | | |
| **SWT 966** | retouch | 1 | 4 | 25.0 | **SWT 966** | retouch | 6 | 20.4 | 15.6 | 3.2 | 1.9 | 18.9 | **SWT 966** | retouch | | 1 | |
| **SWT 968** | retouch | 0 | 6 | 0.0 | **SWT 968** | retouch | 4 | 16.2 | 15 | 2.4 | 1.6 | 16.5 | **SWT 968** | retouch | 1 | | |
| **SWT 976** | retouch | 3 | 7 | 42.9 | **SWT 976** | retouch | 1 | 17 | 9 | 1.5 | 0.7 | 6.5 | **SWT 976** | retouch | 1 | | |
| **SWT 977** | retouch | 2 | 14 | 14.3 | **SWT 977** | retouch | 2 | 28.4 | 16 | 4.5 | 0.4 | 4.4 | **SWT 977** | retouch | 1 | | |
| **SWT 98** | retouch | 1 | 14 | 7.1 | **SWT 98** | retouch | 1 | 44.3 | 24.5 | 10.9 | 0.1 | 0.9 | **SWT 98** | retouch | 1 | | |
| **SWT 981** | retouch | 2 | 13 | 15.4 | **SWT 981** | retouch | 2 | 22 | 18.7 | 4.1 | 0.5 | 4.9 | **SWT 981** | retouch | 1 | | |
| **SWT 989** | retouch | 9 | 13 | 69.2 | **SWT 989** | retouch | 11 | 9.5 | 9.3 | 0.9 | 12.5 | 124.5 | **SWT 989** | retouch | | 1 | |
| **SWT 994** | retouch | 5 | 22 | 22.7 | **SWT 994** | retouch | 4 | 30.2 | 23 | 6.9 | 0.6 | 5.8 | **SWT 994** | retouch | 1 | | |
| **SWT 996** | retouch | 6 | 21 | 28.6 | **SWT 996** | retouch | 4 | 30 | 17.5 | 5.3 | 0.8 | 7.6 | **SWT 996** | retouch | 1 | | |
| **SWT 999** | retouch | 3 | 22 | 13.6 | **SWT 999** | retouch | 1 | 17.7 | 14 | 2.5 | 0.4 | 4.0 | **SWT 999** | retouch | 1 | | |
| **SWT 526** | Retouch | 0 | 3 | 0.0 | **SWT 526** | Retouch | 4 | 17.4 | 13.2 | 2.3 | 1.7 | 17.4 | **SWT 526** | Retouch | 1 | | |
| **SWT 492** | Retouch | 1 | 7 | 14.3 | **SWT 492** | Retouch | 6 | 19.8 | 10 | 2.0 | 3.0 | 30.3 | **SWT 492** | **Retouch** | | 1 | |
| **SWT 770** | Retouch | 0 | 7 | 0.0 | **SWT 770** | Retouch | 0 | 12.2 | 11.3 | 1.4 | 0.0 | 0.0 | **SWT 770** | Retouch | 1 | | |
| **SWT 697** | Retouch | 2 | 8 | 25.0 | **SWT 697** | Retouch | 2 | 26.1 | 16.3 | 4.3 | 0.5 | 4.7 | **SWT 697** | Retouch | 1 | | |
| **SWT 857** | Retouch | 2 | 11 | 18.2 | **SWT 857** | Retouch | 7 | 23.9 | 11.7 | 2.8 | 2.5 | 25.0 | **SWT 857** | Retouch | | 1 | |
| **SWT 300** | Retouch | 2 | 13 | 15.4 | **SWT 300** | Retouch | 5 | 25.3 | 12.8 | 3.2 | 1.5 | 15.4 | **SWT 300** | Retouch | | 1 | |
| **SWT 1098** | scraper | 6 | 21 | 28.6 | **SWT 1098** | scraper | 2 | 24.8 | 23.3 | 5.8 | 0.3 | 3.5 | **SWT 1098** | scraper | | 1 | |
| **SWT 1196** | scraper | 2 | 16 | 12.5 | **SWT 1196** | scraper | 2 | 15.4 | 13.5 | 2.1 | 1.0 | 9.6 | **SWT 1196** | scraper | 1 | | |
| **SWT 123** | scraper | 0 | 10 | 0.0 | **SWT 123** | scraper | 0 | 20.5 | 16.4 | 3.4 | 0.0 | 0.0 | **SWT 123** | scraper | 1 | | |
| **SWT 218** | scraper | 0 | 20 | 0.0 | **SWT 218** | scraper | 5 | 25.6 | 18.4 | 4.7 | 1.1 | 10.6 | **SWT 218** | scraper | 1 | | |
| **SWT 354** | scraper | 8 | 16 | 50.0 | **SWT 354** | scraper | 3 | 41.2 | 18.8 | 7.7 | 0.4 | 3.9 | **SWT 354** | scraper | 1 | | |
| **SWT 703** | scraper | 3 | 20 | 15.0 | **SWT 703** | scraper | 13 | 50.4 | 23.5 | 11.8 | 1.1 | 11.0 | **SWT 703** | scraper | | 1 | |
| **SWT 745** | scraper | 4 | 10 | 40.0 | **SWT 745** | scraper | 4 | 19.4 | 10 | 1.9 | 2.1 | 20.6 | **SWT 745** | scraper | 1 | | |
| **SWT 760** | scraper | 0 | 16 | 0.0 | **SWT 760** | scraper | 0 | 16.2 | 10.2 | 1.7 | 0.0 | 0.0 | **SWT 760** | scraper | 1 | | |
| **SWT 79** | scraper | 1 | 15 | 6.7 | **SWT 79** | scraper | 3 | 23.8 | 13.7 | 3.3 | 0.9 | 9.2 | **SWT 79** | scraper | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 837** | scraper | 3 | 17 | 17.6 | **SWT 837** | scraper | 0 | 20.8 | 13.8 | 2.9 | 0.0 | 0.0 | **SWT 837** | scraper | 1 | | |
| **SWT 845** | scraper | 3 | 14 | 21.4 | **SWT 845** | scraper | 15 | 28 | 13 | 3.6 | 4.1 | 41.2 | **SWT 845** | scraper | | 1 | |
| **SWT 889** | scraper | 0 | 10 | 0.0 | **SWT 889** | scraper | 0 | 24 | 15.2 | 3.6 | 0.0 | 0.0 | **SWT 889** | scraper | 1 | | |
| **SWT 904** | scraper | 1 | 11 | 9.1 | **SWT 904** | scraper | 2 | 13.8 | 13.2 | 1.8 | 1.1 | 11.0 | **SWT 904** | scraper | 1 | | |
| **SWT 927** | scraper | 0 | 5 | 0.0 | **SWT 927** | scraper | 1 | 19.5 | 12 | 2.3 | 0.4 | 4.3 | **SWT 927** | scraper | 1 | | |
| **SWT 971** | scraper | 3 | 16 | 18.8 | **SWT 971** | scraper | 11 | 17.5 | 14.3 | 2.5 | 4.4 | 44.0 | **SWT 971** | scraper | | 1 | |
| **SWT 721** | Scraper | 0 | 6 | 0.0 | **SWT 721** | Scraper | 3 | 19.2 | 15.8 | 3.0 | 1.0 | 9.9 | **SWT 721** | Scraper | 1 | | |
| **SWT 485** | scraper | 0 | 9 | 0.0 | **SWT 485** | scraper | 2 | 14.7 | 11 | 1.6 | 1.2 | 12.4 | **SWT 485** | scraper | 1 | | |
| **SWT 344** | Scraper | 6 | 19 | 31.6 | **SWT 344** | Scraper | 5 | 17 | 13 | 2.2 | 2.3 | 22.6 | **SWT 344** | Scraper | 1 | | |
| **SWT287** | Scraper | 2 | 9 | 22.2 | **SWT287** | Scraper | 3 | 19.4 | 18 | 3.5 | 0.9 | 8.6 | **SWT287** | Scraper | | 1 | |
| **SWT 1197** | Scraper | 0 | 12 | 0.0 | **SWT 1197** | Scraper | 1 | 17.6 | 14.7 | 2.6 | 0.4 | 3.9 | **SWT 1197** | Scraper | 1 | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **375** | | | | 29.2% | **375** | | | | | | | 13.5 | **375** | | 269 | 106 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 71.7 | 28.3 | 0.0 |

**Table 9: Swartkrans Oldowan chert raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **w, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1153** | chunk | 4 | 4 | 100.0 | **SWT 1153** | chunk | 1 | 21.5 | 20.2 | 4.3 | 0.2 | 2.3 | **SWT 1153** | chunk | | 1 | |
| **SWT 119** | chunk | 0 | 15 | 0.0 | **SWT 119** | chunk | 2 | 37.2 | 21.8 | 8.1 | 0.2 | 2.5 | **SWT 119** | chunk | | 1 | |
| **SWT 169** | chunk | 3 | 14 | 21.4 | **SWT 169** | chunk | 2 | 34.6 | 23.1 | 8.0 | 0.3 | 2.5 | **SWT 169** | chunk | | 1 | |
| **SWT 265** | chunk | 1 | 7 | 14.3 | **SWT 265** | chunk | 1 | 22 | 7.6 | 1.7 | 0.6 | 6.0 | **SWT 265** | chunk | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 763** | chunk | 1 | 4 | 25.0 | **SWT 763** | chunk | 1 | 16.2 | 12 | 1.9 | 0.5 | 5.1 | **SWT 763** | chunk | | 1 | |
| **SWT 830** | chunk | 3 | 8 | 37.5 | **SWT 830** | chunk | 3 | 24.3 | 13.7 | 3.3 | 0.9 | 9.0 | **SWT 830** | chunk | | 1 | |
| **SWT 859** | chunk | 3 | 6 | 50.0 | **SWT 859** | chunk | 1 | 15.5 | 15 | 2.3 | 0.4 | 4.3 | **SWT 859** | chunk | | 1 | |
| **SWT 882** | chunk | 1 | 5 | 20.0 | **SWT 882** | chunk | 1 | 25.6 | 20.6 | 5.3 | 0.2 | 1.9 | **SWT 882** | chunk | | 1 | |
| **SWT 893** | chunk | 0 | 3 | 0.0 | **SWT 893** | chunk | 0 | 16 | 12.3 | 2.0 | 0.0 | 0.0 | **SWT 893** | chunk | | 1 | |
| **SWT 901** | chunk | 0 | 4 | 0.0 | **SWT 901** | chunk | 0 | 19.3 | 7.7 | 1.5 | 0.0 | 0.0 | **SWT 901** | chunk | | 1 | |
| **SWT 953** | chunk | 1 | 2 | 50.0 | **SWT 953** | chunk | 2 | 52 | 12.5 | 6.5 | 0.3 | 3.1 | **SWT 953** | chunk | | 1 | |
| **SWT 818** | Chunk | 0 | 2 | 0.0 | **SWT 818** | Chunk | 1 | 13.6 | 9.9 | 1.3 | 0.7 | 7.4 | **SWT 818** | Chunk | 1 | | |
| **SWT 738** | Chunk | 1 | 8 | 12.5 | **SWT 738** | Chunk | 4 | 29.3 | 17.8 | 5.2 | 0.8 | 7.7 | **SWT 738** | Chunk | | 1 | |
| **SWT 750** | core on chunk | 1 | 3 | 33.3 | **SWT 750** | core on chunk | 4 | 28.1 | 20.5 | 5.8 | 0.7 | 6.9 | **SWT 750** | core on chunk | | 1 | |
| **SWT 634** | core, bip | 3 | 3 | 100.0 | **SWT 634** | core, bip | 9 | 33 | 30.8 | 10.2 | 0.9 | 8.9 | **SWT 634** | core, bip | | 1 | |
| **SWT 207** | core, casual | 2 | 4 | 50.0 | **SWT 207** | core, casual | 1 | 58.5 | 55.3 | 32.4 | 0.0 | 0.3 | **SWT 207** | core, casual | | 1 | |
| **SWT 303** | core, casual | 3 | 7 | 42.9 | **SWT 303** | core, casual | 6 | 45.4 | 34.2 | 15.5 | 0.4 | 3.9 | **SWT 303** | core, casual | | 1 | |
| **SWT 543** | core, casual | 3 | 8 | 37.5 | **SWT 543** | core, casual | 1 | 69.4 | 47.3 | 32.8 | 0.0 | 0.3 | **SWT 543** | core, casual | 1 | | |
| **SWT 938** | core, cent | 3 | 8 | 37.5 | **SWT 938** | core, cent | 0 | 44.2 | 40.5 | 17.9 | 0.0 | 0.0 | **SWT 938** | core, cent | | 1 | |
| **SWT 405** | core, frag | 4 | 18 | 22.2 | **SWT 405** | core, frag | 6 | 53.2 | 26 | 13.8 | 0.4 | 4.3 | **SWT 405** | core, frag | 1 | | |
| **SWT 408** | core, pi | 3 | 6 | 50.0 | **SWT 408** | core, pi | 5 | 37.4 | 29 | 10.8 | 0.5 | 4.6 | **SWT 408** | core, pi | | 1 | |
| **SWT 1118** | core, pi / retouch | 8 | 24 | 33.3 | **SWT 1118** | core, pi / retouch | 3 | 39.2 | 33.6 | 13.2 | 0.2 | 2.3 | **SWT 1118** | core, pi / retouch | | 1 | |
| **SWK 851** | flake | 1 | 2 | 50.0 | **SWK 851** | flake | 2 | 22.8 | 21.3 | 4.9 | 0.4 | 4.1 | **SWK 851** | flake | | 1 | |
| **SWT 100** | flake | 1 | 3 | 33.3 | **SWT 100** | flake | 1 | 22.8 | 12 | 2.7 | 0.4 | 3.7 | **SWT 100** | flake | 1 | | |
| **SWT 1001** | flake | 0 | 1 | 0.0 | **SWT 1001** | flake | 0 | 17.3 | 14 | 2.4 | 0.0 | 0.0 | **SWT 1001** | flake | 1 | | |
| **SWT 1004** | flake | 1 | 4 | 25.0 | **SWT 1004** | flake | 1 | 17.7 | 11.6 | 2.1 | 0.5 | 4.9 | **SWT 1004** | flake | | 1 | |
| **SWT 1005** | flake | 0 | 1 | 0.0 | **SWT 1005** | flake | 6 | 27 | 17.8 | 4.8 | 1.2 | 12.5 | **SWT 1005** | flake | 1 | | |
| **SWT 1011** | flake | 0 | 1 | 0.0 | **SWT 1011** | flake | 3 | 19.8 | 19.6 | 3.9 | 0.8 | 7.7 | **SWT 1011** | flake | | 1 | |
| **SWT 1013** | flake | 3 | 7 | 42.9 | **SWT 1013** | flake | 6 | 24.4 | 18.5 | 4.5 | 1.3 | 13.3 | **SWT 1013** | flake | | 1 | |
| **SWT 1014** | flake | 1 | 2 | 50.0 | **SWT 1014** | flake | 4 | 23 | 12.6 | 2.9 | 1.4 | 13.8 | **SWT 1014** | flake | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1016** | flake | 1 | 6 | 16.7 | **SWT 1016** | flake | 0 | 25.4 | 22 | 5.6 | 0.0 | 0.0 | **SWT 1016** | flake | | 1 | |
| **SWT 1022** | flake | 0 | 8 | 0.0 | **SWT 1022** | flake | 1 | 30.8 | 12.7 | 3.9 | 0.3 | 2.6 | **SWT 1022** | flake | | 1 | |
| **SWT 1033** | flake | 0 | 2 | 0.0 | **SWT 1033** | flake | 0 | 26.3 | 12.8 | 3.4 | 0.0 | 0.0 | **SWT 1033** | flake | | 1 | |
| **SWT 1036** | flake | 4 | 4 | 100.0 | **SWT 1036** | flake | 5 | 20 | 17.6 | 3.5 | 1.4 | 14.2 | **SWT 1036** | flake | 1 | | |
| **SWT 1038** | flake | 1 | 7 | 14.3 | **SWT 1038** | flake | 0 | 21.1 | 13 | 2.7 | 0.0 | 0.0 | **SWT 1038** | flake | | 1 | |
| **SWT 1040** | flake | 2 | 5 | 40.0 | **SWT 1040** | flake | 3 | 22 | 12.8 | 2.8 | 1.1 | 10.7 | **SWT 1040** | flake | 1 | | |
| **SWT 1042** | flake | 0 | 4 | 0.0 | **SWT 1042** | flake | 0 | 22 | 6 | 1.3 | 0.0 | 0.0 | **SWT 1042** | flake | 1 | | |
| **SWT 1045** | flake | 1 | 1 | 100.0 | **SWT 1045** | flake | 4 | 58 | 26.8 | 15.5 | 0.3 | 2.6 | **SWT 1045** | flake | 1 | | |
| **SWT 1072** | flake | 0 | 12 | 0.0 | **SWT 1072** | flake | 0 | 30.3 | 21 | 6.4 | 0.0 | 0.0 | **SWT 1072** | flake | 1 | | |
| **SWT 1083** | flake | 1 | 1 | 100.0 | **SWT 1083** | flake | 3 | 21.4 | 18 | 3.9 | 0.8 | 7.8 | **SWT 1083** | flake | | 1 | |
| **SWT 1085** | flake | 1 | 4 | 25.0 | **SWT 1085** | flake | 0 | 28.4 | 15 | 4.3 | 0.0 | 0.0 | **SWT 1085** | flake | | 1 | |
| **SWT 1086** | flake | 4 | 11 | 36.4 | **SWT 1086** | flake | 1 | 46.3 | 42.5 | 19.7 | 0.1 | 0.5 | **SWT 1086** | flake | | 1 | |
| **SWT 1102** | flake | 1 | 2 | 50.0 | **SWT 1102** | flake | 1 | 14.4 | 10.3 | 1.5 | 0.7 | 6.7 | **SWT 1102** | flake | | 1 | |
| **SWT 1103** | flake | 1 | 4 | 25.0 | **SWT 1103** | flake | 1 | 17.2 | 9.5 | 1.6 | 0.6 | 6.1 | **SWT 1103** | flake | | 1 | |
| **SWT 1107** | flake | 1 | 6 | 16.7 | **SWT 1107** | flake | 0 | 22.3 | 12.2 | 2.7 | 0.0 | 0.0 | **SWT 1107** | flake | | 1 | |
| **SWT 1115** | flake | 1 | 5 | 20.0 | **SWT 1115** | flake | 7 | 22.4 | 18 | 4.0 | 1.7 | 17.4 | **SWT 1115** | flake | | 1 | |
| **SWT 1119** | flake | 3 | 6 | 50.0 | **SWT 1119** | flake | 3 | 40 | 20.8 | 8.3 | 0.4 | 3.6 | **SWT 1119** | flake | | 1 | |
| **SWT 1121** | flake | 5 | 9 | 55.6 | **SWT 1121** | flake | 3 | 23.7 | 20.1 | 4.8 | 0.6 | 6.3 | **SWT 1121** | flake | 1 | | |
| **SWT 1122** | flake | 5 | 7 | 71.4 | **SWT 1122** | flake | 7 | 29 | 14.6 | 4.2 | 1.7 | 16.5 | **SWT 1122** | flake | | 1 | |
| **SWT 1123** | flake | 1 | 8 | 12.5 | **SWT 1123** | flake | 6 | 23 | 13.5 | 3.1 | 1.9 | 19.3 | **SWT 1123** | flake | | 1 | |
| **SWT 1127** | flake | 4 | 4 | 100.0 | **SWT 1127** | flake | 0 | 15.1 | 14 | 2.1 | 0.0 | 0.0 | **SWT 1127** | flake | 1 | | |
| **SWT 1131** | flake | 0 | 7 | 0.0 | **SWT 1131** | flake | 0 | 29 | 15.2 | 4.4 | 0.0 | 0.0 | **SWT 1131** | flake | | 1 | |
| **SWT 1138** | flake | 4 | 13 | 30.8 | **SWT 1138** | flake | 4 | 32.4 | 29.6 | 9.6 | 0.4 | 4.2 | **SWT 1138** | flake | 1 | | |
| **SWT 1139** | flake | 6 | 9 | 66.7 | **SWT 1139** | flake | 2 | 23.6 | 12 | 2.8 | 0.7 | 7.1 | **SWT 1139** | flake | 1 | | |
| **SWT 1141** | flake | 6 | 12 | 50.0 | **SWT 1141** | flake | 6 | 30 | 19.6 | 5.9 | 1.0 | 10.2 | **SWT 1141** | flake | | 1 | |
| **SWT 1142** | flake | 1 | 3 | 33.3 | **SWT 1142** | flake | 4 | 19.5 | 11.3 | 2.2 | 1.8 | 18.2 | **SWT 1142** | flake | | 1 | |
| **SWT 1147** | flake | 3 | 13 | 23.1 | **SWT 1147** | flake | 1 | 30.3 | 16 | 4.8 | 0.2 | 2.1 | **SWT 1147** | flake | | 1 | |
| **SWT 1152** | flake | 3 | 16 | 18.8 | **SWT 1152** | flake | 5 | 32.6 | 28.4 | 9.3 | 0.5 | 5.4 | **SWT 1152** | flake | | 1 | |
| **SWT 1157** | flake | 2 | 5 | 40.0 | **SWT 1157** | flake | 0 | 15.2 | 11.1 | 1.7 | 0.0 | 0.0 | **SWT 1157** | flake | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1167** | flake | 1 | 1 | 100.0 | **SWT 1167** | flake | 1 | 31.8 | 27.2 | 8.6 | 0.1 | 1.2 | **SWT 1167** | flake | | 1 | |
| **SWT 1168** | flake | 1 | 3 | 33.3 | **SWT 1168** | flake | 1 | 22.3 | 10 | 2.2 | 0.4 | 4.5 | **SWT 1168** | flake | | 1 | |
| **SWT 1169** | flake | 1 | 13 | 7.7 | **SWT 1169** | flake | 1 | 21.4 | 13.5 | 2.9 | 0.3 | 3.5 | **SWT 1169** | flake | | 1 | |
| **SWT 1177** | flake | 1 | 2 | 50.0 | **SWT 1177** | flake | 1 | 22.4 | 12.1 | 2.7 | 0.4 | 3.7 | **SWT 1177** | flake | 1 | | |
| **SWT 1179** | flake | 2 | 4 | 50.0 | **SWT 1179** | flake | 0 | 18.6 | 10.3 | 1.9 | 0.0 | 0.0 | **SWT 1179** | flake | 1 | | |
| **SWT 1190** | flake | 1 | 1 | 100.0 | **SWT 1190** | flake | 1 | 18.6 | 13.6 | 2.5 | 0.4 | 4.0 | **SWT 1190** | flake | | 1 | |
| **SWT 1199** | flake | 4 | 6 | 66.7 | **SWT 1199** | flake | 1 | 18.6 | 9.6 | 1.8 | 0.6 | 5.6 | **SWT 1199** | flake | | 1 | |
| **SWT 120** | flake | 0 | 2 | 0.0 | **SWT 120** | flake | 1 | 46.8 | 27.4 | 12.8 | 0.1 | 0.8 | **SWT 120** | flake | 1 | | |
| **SWT 133** | flake | 2 | 10 | 20.0 | **SWT 133** | flake | 4 | 21 | 11.8 | 2.5 | 1.6 | 16.1 | **SWT 133** | flake | | 1 | |
| **SWT 134** | flake | 4 | 10 | 40.0 | **SWT 134** | flake | 2 | 26.4 | 28.2 | 7.4 | 0.3 | 2.7 | **SWT 134** | flake | | 1 | |
| **SWT 141** | flake | 1 | 2 | 50.0 | **SWT 141** | flake | 0 | 19 | 16.7 | 3.2 | 0.0 | 0.0 | **SWT 141** | flake | | | 1 |
| **SWT 150** | flake | 2 | 7 | 28.6 | **SWT 150** | flake | 2 | 29 | 20.8 | 6.0 | 0.3 | 3.3 | **SWT 150** | flake | | 1 | |
| **SWT 152** | flake | 3 | 7 | 42.9 | **SWT 152** | flake | 4 | 24.7 | 9.6 | 2.4 | 1.7 | 16.9 | **SWT 152** | flake | | 1 | |
| **SWT 156** | flake | 2 | 3 | 66.7 | **SWT 156** | flake | 11 | 53.1 | 49.7 | 26.4 | 0.4 | 4.2 | **SWT 156** | flake | 1 | | |
| **SWT 162** | flake | 4 | 5 | 80.0 | **SWT 162** | flake | 6 | 41.1 | 28 | 11.5 | 0.5 | 5.2 | **SWT 162** | flake | | 1 | |
| **SWT 167** | flake | 1 | 6 | 16.7 | **SWT 167** | flake | 4 | 21.4 | 11.6 | 2.5 | 1.6 | 16.1 | **SWT 167** | flake | | 1 | |
| **SWT 170** | flake | 1 | 4 | 25.0 | **SWT 170** | flake | 0 | 21.1 | 17 | 3.6 | 0.0 | 0.0 | **SWT 170** | flake | | 1 | |
| **SWT 185** | flake | 0 | 9 | 0.0 | **SWT 185** | flake | 1 | 35 | 26 | 9.1 | 0.1 | 1.1 | **SWT 185** | flake | 1 | | |
| **SWT 192** | flake | 1 | 1 | 100.0 | **SWT 192** | flake | 12 | 32.2 | 16.8 | 5.4 | 2.2 | 22.2 | **SWT 192** | flake | | 1 | |
| **SWT 200** | flake | 2 | 2 | 100.0 | **SWT 200** | flake | 5 | 20 | 16.2 | 3.2 | 1.5 | 15.4 | **SWT 200** | flake | | 1 | |
| **SWT 205** | flake | 2 | 3 | 66.7 | **SWT 205** | flake | 2 | 34 | 27.7 | 9.4 | 0.2 | 2.1 | **SWT 205** | flake | | 1 | |
| **SWT 206** | flake | 3 | 5 | 60.0 | **SWT 206** | flake | 7 | 30.7 | 17.3 | 5.3 | 1.3 | 13.2 | **SWT 206** | flake | | 1 | |
| **SWT 228** | flake | 1 | 5 | 20.0 | **SWT 228** | flake | 3 | 20.4 | 16.6 | 3.4 | 0.9 | 8.9 | **SWT 228** | flake | | 1 | |
| **SWT 230** | flake | 4 | 11 | 36.4 | **SWT 230** | flake | 5 | 33 | 30.8 | 10.2 | 0.5 | 4.9 | **SWT 230** | flake | | 1 | |
| **SWT 233** | flake | 1 | 4 | 25.0 | **SWT 233** | flake | 2 | 14.7 | 14.5 | 2.1 | 0.9 | 9.4 | **SWT 233** | flake | 1 | | |
| **SWT 240** | flake | 3 | 12 | 25.0 | **SWT 240** | flake | 7 | 21.3 | 16.6 | 3.5 | 2.0 | 19.8 | **SWT 240** | flake | | 1 | |
| **SWT 245** | flake | 3 | 3 | 100.0 | **SWT 245** | flake | 2 | 27 | 14.2 | 3.8 | 0.5 | 5.2 | **SWT 245** | flake | | 1 | |
| **SWT 26** | flake | 3 | 4 | 75.0 | **SWT 26** | flake | 1 | 32.5 | 26.8 | 8.7 | 0.1 | 1.1 | **SWT 26** | flake | | 1 | |
| **SWT 261** | flake | 3 | 4 | 75.0 | **SWT 261** | flake | 1 | 26 | 10.7 | 2.8 | 0.4 | 3.6 | **SWT 261** | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 266** | flake | 3 | 8 | 37.5 | **SWT 266** | flake | 4 | 18.2 | 15 | 2.7 | 1.5 | 14.7 | **SWT 266** | flake | | 1 | |
| **SWT 278** | flake | 5 | 12 | 41.7 | **SWT 278** | flake | 9 | 38.7 | 33 | 12.8 | 0.7 | 7.0 | **SWT 278** | flake | | 1 | |
| **SWT 298** | flake | 1 | 5 | 20.0 | **SWT 298** | flake | 1 | 37.6 | 19.2 | 7.2 | 0.1 | 1.4 | **SWT 298** | flake | | 1 | |
| **SWT 299** | flake | 0 | 9 | 0.0 | **SWT 299** | flake | 1 | 36.3 | 12.5 | 4.5 | 0.2 | 2.2 | **SWT 299** | flake | | 1 | |
| **SWT 358** | flake | 0 | 5 | 0.0 | **SWT 358** | flake | 0 | 13 | 11.4 | 1.5 | 0.0 | 0.0 | **SWT 358** | flake | | 1 | |
| **SWT 369** | flake | 0 | 8 | 0.0 | **SWT 369** | flake | 1 | 29.2 | 25 | 7.3 | 0.1 | 1.4 | **SWT 369** | flake | | 1 | |
| **SWT 370** | flake | 2 | 3 | 66.7 | **SWT 370** | flake | 3 | 23.6 | 15 | 3.5 | 0.8 | 8.5 | **SWT 370** | flake | | 1 | |
| **SWT 389** | flake | 1 | 1 | 100.0 | **SWT 389** | flake | 2 | 44.3 | 39.8 | 17.6 | 0.1 | 1.1 | **SWT 389** | flake | | | 1 |
| **SWT 407** | flake | 0 | 1 | 0.0 | **SWT 407** | flake | 0 | 22 | 13 | 2.9 | 0.0 | 0.0 | **SWT 407** | flake | | 1 | |
| **SWT 409** | flake | 7 | 8 | 87.5 | **SWT 409** | flake | 2 | 22.1 | 17.2 | 3.8 | 0.5 | 5.3 | **SWT 409** | flake | 1 | | |
| **SWT 414** | flake | 2 | 4 | 50.0 | **SWT 414** | flake | 2 | 40 | 27.7 | 11.1 | 0.2 | 1.8 | **SWT 414** | flake | | 1 | |
| **SWT 415** | flake | 2 | 4 | 50.0 | **SWT 415** | flake | 3 | 18 | 12 | 2.2 | 1.4 | 13.9 | **SWT 415** | flake | | 1 | |
| **SWT 422** | flake | 2 | 2 | 100.0 | **SWT 422** | flake | 3 | 22.2 | 19.5 | 4.3 | 0.7 | 6.9 | **SWT 422** | flake | 1 | | |
| **SWT 440** | flake | 0 | 3 | 0.0 | **SWT 440** | flake | 0 | 19.7 | 12.1 | 2.4 | 0.0 | 0.0 | **SWT 440** | flake | | 1 | |
| **SWT 451** | flake | 3 | 3 | 100.0 | **SWT 451** | flake | 4 | 31.2 | 26.8 | 8.4 | 0.5 | 4.8 | **SWT 451** | flake | | 1 | |
| **SWT 462** | flake | 1 | 12 | 8.3 | **SWT 462** | flake | 1 | 42.7 | 40 | 17.1 | 0.1 | 0.6 | **SWT 462** | flake | 1 | | |
| **SWT 678** | flake | 3 | 3 | 100.0 | **SWT 678** | flake | 3 | 19 | 17.7 | 3.4 | 0.9 | 8.9 | **SWT 678** | flake | | 1 | |
| **SWT 686** | flake | 0 | 6 | 0.0 | **SWT 686** | flake | 2 | 23 | 16 | 3.7 | 0.5 | 5.4 | **SWT 686** | flake | | 1 | |
| **SWT 72** | flake | 0 | 1 | 0.0 | **SWT 72** | flake | 1 | 26 | 17.6 | 4.6 | 0.2 | 2.2 | **SWT 72** | flake | | 1 | |
| **SWT 734** | flake | 1 | 3 | 33.3 | **SWT 734** | flake | 5 | 17.4 | 17.1 | 3.0 | 1.7 | 16.8 | **SWT 734** | flake | | 1 | |
| **SWT 741** | flake | 3 | 8 | 37.5 | **SWT 741** | flake | 3 | 21.3 | 17 | 3.6 | 0.8 | 8.3 | **SWT 741** | flake | | 1 | |
| **SWT 778** | flake | 2 | 3 | 66.7 | **SWT 778** | flake | 6 | 24.3 | 16.6 | 4.0 | 1.5 | 14.9 | **SWT 778** | flake | | 1 | |
| **SWT 781** | flake | 1 | 2 | 50.0 | **SWT 781** | flake | 3 | 24.8 | 18 | 4.5 | 0.7 | 6.7 | **SWT 781** | flake | | 1 | |
| **SWT 782** | flake | 1 | 1 | 100.0 | **SWT 782** | flake | 3 | 29.6 | 21.1 | 6.2 | 0.5 | 4.8 | **SWT 782** | flake | | 1 | |
| **SWT 788** | flake | 1 | 3 | 33.3 | **SWT 788** | flake | 0 | 25 | 16.4 | 4.1 | 0.0 | 0.0 | **SWT 788** | flake | 1 | | |
| **SWT 790** | flake | 4 | 4 | 100.0 | **SWT 790** | flake | 3 | 32.4 | 15.1 | 4.9 | 0.6 | 6.1 | **SWT 790** | flake | | 1 | |
| **SWT 796** | flake | 0 | 5 | 0.0 | **SWT 796** | flake | 7 | 26 | 17.2 | 4.5 | 1.6 | 15.7 | **SWT 796** | flake | | 1 | |
| **SWT 797** | flake | 3 | 7 | 42.9 | **SWT 797** | flake | 0 | 21.3 | 11.7 | 2.5 | 0.0 | 0.0 | **SWT 797** | flake | | 1 | |
| **SWT 834** | flake | 2 | 8 | 25.0 | **SWT 834** | flake | 1 | 34 | 23.8 | 8.1 | 0.1 | 1.2 | **SWT 834** | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 842** | flake | 2 | 3 | 66.7 | **SWT 842** | flake | 2 | 20 | 18.5 | 3.7 | 0.5 | 5.4 | **SWT 842** | flake | | 1 | |
| **SWT 844** | flake | 1 | 4 | 25.0 | **SWT 844** | flake | 1 | 17 | 11.6 | 2.0 | 0.5 | 5.1 | **SWT 844** | flake | 1 | | |
| **SWT 846** | flake | 2 | 2 | 100.0 | **SWT 846** | flake | 2 | 22 | 13 | 2.9 | 0.7 | 7.0 | **SWT 846** | flake | | 1 | |
| **SWT 847** | flake | 1 | 1 | 100.0 | **SWT 847** | flake | 1 | 35 | 19.5 | 6.8 | 0.1 | 1.5 | **SWT 847** | flake | 1 | | |
| **SWT 852** | flake | 1 | 1 | 100.0 | **SWT 852** | flake | 2 | 24.4 | 24.1 | 5.9 | 0.3 | 3.4 | **SWT 852** | flake | | 1 | |
| **SWT 861** | flake | 5 | 9 | 55.6 | **SWT 861** | flake | 1 | 20.8 | 19.1 | 4.0 | 0.3 | 2.5 | **SWT 861** | flake | | 1 | |
| **SWT 868** | flake | 0 | 6 | 0.0 | **SWT 868** | flake | 0 | 15.3 | 13.8 | 2.1 | 0.0 | 0.0 | **SWT 868** | flake | | 1 | |
| **SWT 870** | flake | 6 | 11 | 54.5 | **SWT 870** | flake | 3 | 30.8 | 25.2 | 7.8 | 0.4 | 3.9 | **SWT 870** | flake | | 1 | |
| **SWT 873** | flake | 0 | 2 | 0.0 | **SWT 873** | flake | 0 | 26.4 | 17.7 | 4.7 | 0.0 | 0.0 | **SWT 873** | flake | | 1 | |
| **SWT 877** | flake | 4 | 6 | 66.7 | **SWT 877** | flake | 1 | 16.8 | 16 | 2.7 | 0.4 | 3.7 | **SWT 877** | flake | 1 | | |
| **SWT 878** | flake | 1 | 2 | 50.0 | **SWT 878** | flake | 0 | 17 | 15.2 | 2.6 | 0.0 | 0.0 | **SWT 878** | flake | | 1 | |
| **SWT 879** | flake | 1 | 5 | 20.0 | **SWT 879** | flake | 0 | 21 | 9.4 | 2.0 | 0.0 | 0.0 | **SWT 879** | flake | | 1 | |
| **SWT 883** | flake | 0 | 5 | 0.0 | **SWT 883** | flake | 2 | 26 | 14.1 | 3.7 | 0.5 | 5.5 | **SWT 883** | flake | | 1 | |
| **SWT 890** | flake | 2 | 4 | 50.0 | **SWT 890** | flake | 0 | 21.4 | 8.4 | 1.8 | 0.0 | 0.0 | **SWT 890** | flake | 1 | | |
| **SWT 892** | flake | 2 | 3 | 66.7 | **SWT 892** | flake | 4 | 16.3 | 17.3 | 2.8 | 1.4 | 14.2 | **SWT 892** | flake | | 1 | |
| **SWT 895** | flake | 1 | 1 | 100.0 | **SWT 895** | flake | 4 | 33.5 | 25 | 8.4 | 0.5 | 4.8 | **SWT 895** | flake | | 1 | |
| **SWT 896** | flake | 0 | 3 | 0.0 | **SWT 896** | flake | 0 | 16.8 | 16.4 | 2.8 | 0.0 | 0.0 | **SWT 896** | flake | | 1 | |
| **SWT 900** | flake | 0 | 14 | 0.0 | **SWT 900** | flake | 2 | 20.4 | 13.4 | 2.7 | 0.7 | 7.3 | **SWT 900** | flake | | 1 | |
| **SWT 902** | flake | 1 | 1 | 100.0 | **SWT 902** | flake | 3 | 15 | 13.3 | 2.0 | 1.5 | 15.0 | **SWT 902** | flake | | 1 | |
| **SWT 903** | flake | 1 | 6 | 16.7 | **SWT 903** | flake | 1 | 24 | 10.2 | 2.4 | 0.4 | 4.1 | **SWT 903** | flake | | 1 | |
| **SWT 912** | flake | 1 | 4 | 25.0 | **SWT 912** | flake | 1 | 18 | 12 | 2.2 | 0.5 | 4.6 | **SWT 912** | flake | | 1 | |
| **SWT 915** | flake | 0 | 2 | 0.0 | **SWT 915** | flake | 0 | 14.7 | 7.2 | 1.1 | 0.0 | 0.0 | **SWT 915** | flake | 1 | | |
| **SWT 917** | flake | 2 | 4 | 50.0 | **SWT 917** | flake | 1 | 15.2 | 10 | 1.5 | 0.7 | 6.6 | **SWT 917** | flake | 1 | | |
| **SWT 918** | flake | 2 | 5 | 40.0 | **SWT 918** | flake | 1 | 25 | 11 | 2.8 | 0.4 | 3.6 | **SWT 918** | flake | | 1 | |
| **SWT 918** | flake | 1 | 1 | 100.0 | **SWT 918** | flake | 0 | 18 | 15 | 2.7 | 0.0 | 0.0 | **SWT 918** | flake | | 1 | |
| **SWT 919** | flake | 2 | 4 | 50.0 | **SWT 919** | flake | 1 | 13 | 13 | 1.7 | 0.6 | 5.9 | **SWT 919** | flake | | 1 | |
| **SWT 920** | flake | 3 | 6 | 50.0 | **SWT 920** | flake | 1 | 19.3 | 8.4 | 1.6 | 0.6 | 6.2 | **SWT 920** | flake | | 1 | |
| **SWT 926** | flake | 0 | 4 | 0.0 | **SWT 926** | flake | 2 | 20.7 | 14.3 | 3.0 | 0.7 | 6.8 | **SWT 926** | flake | | 1 | |
| **SWT 93** | flake | 4 | 7 | 57.1 | **SWT 93** | flake | 5 | 40 | 10 | 4.0 | 1.3 | 12.5 | **SWT 93** | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 94** | flake | 1 | 15 | 6.7 | **SWT 94** | flake | 2 | 17.7 | 17.2 | 3.0 | 0.7 | 6.6 | **SWT 94** | flake | | 1 | |
| **SWT 940** | flake | 1 | 1 | 100.0 | **SWT 940** | flake | 0 | 22.7 | 17.7 | 4.0 | 0.0 | 0.0 | **SWT 940** | flake | | | 1 |
| **SWT 942** | flake | 3 | 4 | 75.0 | **SWT 942** | flake | 1 | 57.7 | 18 | 10.4 | 0.1 | 1.0 | **SWT 942** | flake | | 1 | |
| **SWT 944** | flake | 5 | 5 | 100.0 | **SWT 944** | flake | 7 | 15.8 | 11.6 | 1.8 | 3.8 | 38.2 | **SWT 944** | flake | | 1 | |
| **SWT 945** | flake | 3 | 7 | 42.9 | **SWT 945** | flake | 1 | 22.6 | 9.8 | 2.2 | 0.5 | 4.5 | **SWT 945** | flake | 1 | | |
| **SWT 948** | flake | 1 | 3 | 33.3 | **SWT 948** | flake | 1 | 16 | 15 | 2.4 | 0.4 | 4.2 | **SWT 948** | flake | | 1 | |
| **SWT 959** | flake | 2 | 6 | 33.3 | **SWT 959** | flake | 1 | 39.2 | 33 | 12.9 | 0.1 | 0.8 | **SWT 959** | flake | | 1 | |
| **SWT 972** | flake | 1 | 1 | 100.0 | **SWT 972** | flake | 1 | 22 | 14.4 | 3.2 | 0.3 | 3.2 | **SWT 972** | flake | 1 | | |
| **SWT 986** | flake | 0 | 2 | 0.0 | **SWT 986** | flake | 1 | 23 | 8 | 1.8 | 0.5 | 5.4 | **SWT 986** | flake | | 1 | |
| **SWT 988** | flake | 0 | 5 | 0.0 | **SWT 988** | flake | 3 | 21.6 | 9.7 | 2.1 | 1.4 | 14.3 | **SWT 988** | flake | | 1 | |
| **SWT 990** | flake | 4 | 17 | 23.5 | **SWT 990** | flake | 2 | 25.8 | 17 | 4.4 | 0.5 | 4.6 | **SWT 990** | flake | | 1 | |
| **SWT 138** | Flake | 0 | 6 | 0.0 | **SWT 138** | Flake | 2 | 34.7 | 27 | 9.4 | 0.2 | 2.1 | **SWT 138** | Flake | 1 | | |
| **SWT 499** | Flake | 1 | 1 | 100.0 | **SWT 499** | Flake | 1 | 21.4 | 13.9 | 3.0 | 0.3 | 3.4 | **SWT 499** | Flake | | 1 | |
| **SWT 546** | Flake | 1 | 1 | 100.0 | **SWT 546** | Flake | 7 | 21 | 19.9 | 4.2 | 1.7 | 16.8 | **SWT 546** | Flake | 1 | | |
| **SWT 570** | Flake | 1 | 2 | 50.0 | **SWT 570** | Flake | 1 | 18.6 | 10.7 | 2.0 | 0.5 | 5.0 | **SWT 570** | Flake | 1 | | |
| **SWT 590** | Flake | 3 | 3 | 100.0 | **SWT 590** | Flake | 8 | 39.9 | 34.3 | 13.7 | 0.6 | 5.8 | **SWT 590** | Flake | 1 | | |
| **SWT 518** | Flake | 1 | 3 | 33.3 | **SWT 518** | Flake | 1 | 23 | 11.6 | 2.7 | 0.4 | 3.7 | **SWT 518** | Flake | 1 | | |
| **SWT 1019** | Flake | 0 | 4 | 0.0 | **SWT 1019** | Flake | 2 | 26.3 | 14 | 3.7 | 0.5 | 5.4 | **SWT 1019** | Flake | | 1 | |
| **SWT 459** | Flake | 0 | 3 | 0.0 | **SWT 459** | Flake | 6 | 19 | 16.4 | 3.1 | 1.9 | 19.3 | **SWT 459** | Flake | | 1 | |
| **SWT 180** | Flake | 1 | 2 | 50.0 | **SWT 180** | Flake | 1 | 16.6 | 13.2 | 2.2 | 0.5 | 4.6 | **SWT 180** | Flake | | 1 | |
| **SWT 514** | Flake | 4 | 4 | 100.0 | **SWT 514** | Flake | 3 | 17.6 | 12.5 | 2.2 | 1.4 | 13.6 | **SWT 514** | Flake | | 1 | |
| **SWT 786** | Flake | 0 | 1 | 0.0 | **SWT 786** | Flake | 0 | 27 | 20 | 5.4 | 0.0 | 0.0 | **SWT 786** | Flake | | 1 | |
| **SWT 1126** | Flake | 0 | 1 | 0.0 | **SWT 1126** | Flake | 1 | 16.8 | 8.5 | 1.4 | 0.7 | 7.0 | **SWT 1126** | Flake | 1 | | |
| **SWT 1089** | Flake | 0 | 2 | 0.0 | **SWT 1089** | Flake | 2 | 24.8 | 16.5 | 4.1 | 0.5 | 4.9 | **SWT 1089** | Flake | | 1 | |
| **SWT 811** | Flake | 2 | 9 | 22.2 | **SWT 811** | Flake | 1 | 26 | 15.6 | 4.1 | 0.2 | 2.5 | **SWT 811** | Flake | | 1 | |
| **SWT 594** | Flake | 0 | 4 | 0.0 | **SWT 594** | Flake | 0 | 13.6 | 9.8 | 1.3 | 0.0 | 0.0 | **SWT 594** | Flake | | 1 | |
| **SWT 9** | flake/ blade | 1 | 2 | 50.0 | **SWT 9** | blade | 3 | 38.8 | 14.7 | 5.7 | 0.5 | 5.3 | **SWT 9** | blade | | 1 | |
| **SWT 1000** | retouch | 1 | 7 | 14.3 | **SWT 1000** | retouch | 1 | 20.7 | 15.8 | 3.3 | 0.3 | 3.1 | **SWT 1000** | retouch | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 1003** | retouch | 0 | 14 | 0.0 | **SWT 1003** | retouch | 2 | 16 | 12.8 | 2.0 | 1.0 | 9.8 | **SWT 1003** | retouch | | 1 | |
| **SWT 1006** | retouch | 0 | 4 | 0.0 | **SWT 1006** | retouch | 1 | 26.5 | 19.8 | 5.2 | 0.2 | 1.9 | **SWT 1006** | retouch | | 1 | |
| **SWT 1020** | retouch | 2 | 9 | 22.2 | **SWT 1020** | retouch | 2 | 25 | 17.7 | 4.4 | 0.5 | 4.5 | **SWT 1020** | retouch | 1 | | |
| **SWT 1028** | retouch | 0 | 1 | 0.0 | **SWT 1028** | retouch | 2 | 18.8 | 11.6 | 2.2 | 0.9 | 9.2 | **SWT 1028** | retouch | | 1 | |
| **SWT 1052** | retouch | 0 | 15 | 0.0 | **SWT 1052** | retouch | 0 | 39 | 23 | 9.0 | 0.0 | 0.0 | **SWT 1052** | retouch | 1 | | |
| **SWT 1060** | retouch | 2 | 5 | 40.0 | **SWT 1060** | retouch | 2 | 31.1 | 26 | 8.1 | 0.2 | 2.5 | **SWT 1060** | retouch | | 1 | |
| **SWT 1061** | retouch | 0 | 10 | 0.0 | **SWT 1061** | retouch | 1 | 21.5 | 18.6 | 4.0 | 0.3 | 2.5 | **SWT 1061** | retouch | | 1 | |
| **SWT 1064** | retouch | 0 | 10 | 0.0 | **SWT 1064** | retouch | 0 | 26 | 22 | 5.7 | 0.0 | 0.0 | **SWT 1064** | retouch | | 1 | |
| **SWT 1067** | retouch | 1 | 8 | 12.5 | **SWT 1067** | retouch | 3 | 34 | 30.7 | 10.4 | 0.3 | 2.9 | **SWT 1067** | retouch | | 1 | |
| **SWT 1069** | retouch | 4 | 6 | 66.7 | **SWT 1069** | retouch | 5 | 37 | 22.6 | 8.4 | 0.6 | 6.0 | **SWT 1069** | retouch | | 1 | |
| **SWT 1078** | retouch | 3 | 17 | 17.6 | **SWT 1078** | retouch | 11 | 40.4 | 40 | 16.2 | 0.7 | 6.8 | **SWT 1078** | retouch | | 1 | |
| **SWT 1108** | retouch | 7 | 12 | 58.3 | **SWT 1108** | retouch | 4 | 24.5 | 10 | 2.5 | 1.6 | 16.3 | **SWT 1108** | retouch | 1 | | |
| **SWT 1111** | retouch | 6 | 21 | 28.6 | **SWT 1111** | retouch | 1 | 30.4 | 23 | 7.0 | 0.1 | 1.4 | **SWT 1111** | retouch | 1 | | |
| **SWT 1114** | retouch | 6 | 19 | 31.6 | **SWT 1114** | retouch | 2 | 23 | 19.3 | 4.4 | 0.5 | 4.5 | **SWT 1114** | retouch | 1 | | |
| **SWT 1124** | retouch | 5 | 12 | 41.7 | **SWT 1124** | retouch | 1 | 16 | 8.7 | 1.4 | 0.7 | 7.2 | **SWT 1124** | retouch | | 1 | |
| **SWT 1125** | retouch | 3 | 8 | 37.5 | **SWT 1125** | retouch | 2 | 19.8 | 13.7 | 2.7 | 0.7 | 7.4 | **SWT 1125** | retouch | | 1 | |
| **SWT 1133** | retouch | 2 | 9 | 22.2 | **SWT 1133** | retouch | 3 | 25.5 | 20 | 5.1 | 0.6 | 5.9 | **SWT 1133** | retouch | | 1 | |
| **SWT 114** | retouch | 4 | 21 | 19.0 | **SWT 114** | retouch | 4 | 26 | 24 | 6.2 | 0.6 | 6.4 | **SWT 114** | retouch | | 1 | |
| **SWT 1143** | retouch | 3 | 11 | 27.3 | **SWT 1143** | retouch | 4 | 31 | 26.3 | 8.2 | 0.5 | 4.9 | **SWT 1143** | retouch | | 1 | |
| **SWT 1162** | retouch | 1 | 17 | 5.9 | **SWT 1162** | retouch | 4 | 26.7 | 15.5 | 4.1 | 1.0 | 9.7 | **SWT 1162** | retouch | | 1 | |
| **SWT 1165** | retouch | 4 | 11 | 36.4 | **SWT 1165** | retouch | 2 | 20 | 15.5 | 3.1 | 0.6 | 6.5 | **SWT 1165** | retouch | 1 | | |
| **SWT 1174** | retouch | 3 | 9 | 33.3 | **SWT 1174** | retouch | 2 | 20.4 | 10.7 | 2.2 | 0.9 | 9.2 | **SWT 1174** | retouch | | 1 | |
| **SWT 135** | retouch | 3 | 7 | 42.9 | **SWT 135** | retouch | 3 | 26.6 | 24.2 | 6.4 | 0.5 | 4.7 | **SWT 135** | retouch | | 1 | |
| **SWT 138** | retouch | 2 | 5 | 40.0 | **SWT 138** | retouch | 1 | 20.4 | 15.2 | 3.1 | 0.3 | 3.2 | **SWT 138** | retouch | | 1 | |
| **SWT 146** | retouch | 0 | 19 | 0.0 | **SWT 146** | retouch | 1 | 52.6 | 27.5 | 14.5 | 0.1 | 0.7 | **SWT 146** | retouch | | 1 | |
| **SWT 148** | retouch | 3 | 15 | 20.0 | **SWT 148** | retouch | 4 | 21 | 16.5 | 3.5 | 1.2 | 11.5 | **SWT 148** | retouch | | 1 | |
| **SWT 160** | retouch | 1 | 5 | 20.0 | **SWT 160** | retouch | 2 | 52 | 25 | 13.0 | 0.2 | 1.5 | **SWT 160** | retouch | | 1 | |
| **SWT 171** | retouch | 4 | 17 | 23.5 | **SWT 171** | retouch | 2 | 36 | 23 | 8.3 | 0.2 | 2.4 | **SWT 171** | retouch | | 1 | |
| **SWT 172** | retouch | 4 | 17 | 23.5 | **SWT 172** | retouch | 7 | 29 | 21.8 | 6.3 | 1.1 | 11.1 | **SWT 172** | retouch | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 181** | retouch | 7 | 19 | 36.8 | **SWT 181** | retouch | 3 | 21.8 | 16.3 | 3.6 | 0.8 | 8.4 | **SWT 181** | retouch | | 1 | |
| **SWT 201** | retouch | 2 | 14 | 14.3 | **SWT 201** | retouch | 4 | 26 | 16.6 | 4.3 | 0.9 | 9.3 | **SWT 201** | retouch | | 1 | |
| **SWT 202** | retouch | 7 | 10 | 70.0 | **SWT 202** | retouch | 3 | 22.7 | 12.5 | 2.8 | 1.1 | 10.6 | **SWT 202** | retouch | | 1 | |
| **SWT 204** | retouch | 3 | 10 | 30.0 | **SWT 204** | retouch | 2 | 31 | 16.4 | 5.1 | 0.4 | 3.9 | **SWT 204** | retouch | 1 | | |
| **SWT 227** | retouch | 7 | 9 | 77.8 | **SWT 227** | retouch | 1 | 31.5 | 23.6 | 7.4 | 0.1 | 1.3 | **SWT 227** | retouch | | 1 | |
| **SWT 229** | retouch | 3 | 18 | 16.7 | **SWT 229** | retouch | 6 | 35 | 34.8 | 12.2 | 0.5 | 4.9 | **SWT 229** | retouch | 1 | | |
| **SWT 244** | retouch | 0 | 7 | 0.0 | **SWT 244** | retouch | 0 | 14.7 | 12 | 1.8 | 0.0 | 0.0 | **SWT 244** | retouch | | 1 | |
| **SWT 263** | retouch | 1 | 7 | 14.3 | **SWT 263** | retouch | 0 | 23.3 | 19.6 | 4.6 | 0.0 | 0.0 | **SWT 263** | retouch | | 1 | |
| **SWT 27** | retouch | 3 | 9 | 33.3 | **SWT 27** | retouch | 2 | 45 | 21 | 9.5 | 0.2 | 2.1 | **SWT 27** | retouch | | 1 | |
| **SWT 296** | retouch | 4 | 14 | 28.6 | **SWT 296** | retouch | 2 | 22.4 | 18 | 4.0 | 0.5 | 5.0 | **SWT 296** | retouch | | 1 | |
| **SWT 305** | retouch | 6 | 19 | 31.6 | **SWT 305** | retouch | 7 | 43.7 | 41 | 17.9 | 0.4 | 3.9 | **SWT 305** | retouch | | 1 | |
| **SWT 307** | retouch | 7 | 20 | 35.0 | **SWT 307** | retouch | 3 | 50.6 | 45.3 | 22.9 | 0.1 | 1.3 | **SWT 307** | retouch | 1 | | |
| **SWT 316** | retouch | 4 | 14 | 28.6 | **SWT 316** | retouch | 5 | 29 | 22 | 6.4 | 0.8 | 7.8 | **SWT 316** | retouch | | 1 | |
| **SWT 317** | retouch | 3 | 5 | 60.0 | **SWT 317** | retouch | 6 | 44.7 | 28.8 | 12.9 | 0.5 | 4.7 | **SWT 317** | retouch | | 1 | |
| **SWT 32** | retouch | 3 | 6 | 50.0 | **SWT 32** | retouch | 5 | 48.5 | 29 | 14.1 | 0.4 | 3.6 | **SWT 32** | retouch | | 1 | |
| **SWT 324** | retouch | 4 | 18 | 22.2 | **SWT 324** | retouch | 1 | 51.4 | 26 | 13.4 | 0.1 | 0.7 | **SWT 324** | retouch | 1 | | |
| **SWT 338** | retouch | 2 | 15 | 13.3 | **SWT 338** | retouch | 9 | 52.4 | 30.5 | 16.0 | 0.6 | 5.6 | **SWT 338** | retouch | | 1 | |
| **SWT 340** | retouch | 5 | 20 | 25.0 | **SWT 340** | retouch | 4 | 32.7 | 27 | 8.8 | 0.5 | 4.5 | **SWT 340** | retouch | | 1 | |
| **SWT 341** | retouch | 3 | 13 | 23.1 | **SWT 341** | retouch | 2 | 22.6 | 20.7 | 4.7 | 0.4 | 4.3 | **SWT 341** | retouch | | 1 | |
| **SWT 352** | retouch | 0 | 21 | 0.0 | **SWT 352** | retouch | 6 | 32.8 | 26.8 | 8.8 | 0.7 | 6.8 | **SWT 352** | retouch | 1 | | |
| **SWT 353** | retouch | 2 | 13 | 15.4 | **SWT 353** | retouch | 2 | 22.3 | 18.8 | 4.2 | 0.5 | 4.8 | **SWT 353** | retouch | | 1 | |
| **SWT 356** | retouch | 1 | 12 | 8.3 | **SWT 356** | retouch | 3 | 32 | 26 | 8.3 | 0.4 | 3.6 | **SWT 356** | retouch | | 1 | |
| **SWT 360** | retouch | 3 | 12 | 25.0 | **SWT 360** | retouch | 10 | 27.5 | 22.8 | 6.3 | 1.6 | 15.9 | **SWT 360** | retouch | 1 | | |
| **SWT 362** | retouch | 2 | 9 | 22.2 | **SWT 362** | retouch | 1 | 15 | 15 | 2.3 | 0.4 | 4.4 | **SWT 362** | retouch | | 1 | |
| **SWT 363** | retouch | 1 | 12 | 8.3 | **SWT 363** | retouch | 3 | 44.4 | 36.2 | 16.1 | 0.2 | 1.9 | **SWT 363** | retouch | | 1 | |
| **SWT 377** | retouch | 3 | 14 | 21.4 | **SWT 377** | retouch | 2 | 23 | 13 | 3.0 | 0.7 | 6.7 | **SWT 377** | retouch | | 1 | |
| **SWT 379** | retouch | 4 | 18 | 22.2 | **SWT 379** | retouch | 3 | 24 | 14 | 3.4 | 0.9 | 8.9 | **SWT 379** | retouch | | 1 | |
| **SWT 381** | retouch | 6 | 11 | 54.5 | **SWT 381** | retouch | 7 | 21.7 | 21.7 | 4.7 | 1.5 | 14.9 | **SWT 381** | retouch | | 1 | |
| **SWT 383** | retouch | 5 | 15 | 33.3 | **SWT 383** | retouch | 5 | 22.7 | 19 | 4.3 | 1.2 | 11.6 | **SWT 383** | retouch | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 384** | retouch | 0 | 11 | 0.0 | **SWT 384** | retouch | 4 | 19.8 | 13.8 | 2.7 | 1.5 | 14.6 | **SWT 384** | retouch | | 1 | |
| **SWT 397** | retouch | 2 | 10 | 20.0 | **SWT 397** | retouch | 1 | 22 | 17 | 3.7 | 0.3 | 2.7 | **SWT 397** | retouch | | 1 | |
| **SWT 417** | retouch | 6 | 12 | 50.0 | **SWT 417** | retouch | 3 | 31.2 | 20 | 6.2 | 0.5 | 4.8 | **SWT 417** | retouch | | 1 | |
| **SWT 449** | retouch | 3 | 12 | 25.0 | **SWT 449** | retouch | 0 | 46.8 | 14.5 | 6.8 | 0.0 | 0.0 | **SWT 449** | retouch | 1 | | |
| **SWT 450** | retouch | 1 | 7 | 14.3 | **SWT 450** | retouch | 3 | 31 | 18 | 5.6 | 0.5 | 5.4 | **SWT 450** | retouch | 1 | | |
| **SWT 457** | retouch | 3 | 8 | 37.5 | **SWT 457** | retouch | 2 | 26 | 23 | 6.0 | 0.3 | 3.3 | **SWT 457** | retouch | | 1 | |
| **SWT 464** | retouch | 4 | 15 | 26.7 | **SWT 464** | retouch | 0 | 18.7 | 16.8 | 3.1 | 0.0 | 0.0 | **SWT 464** | retouch | | 1 | |
| **SWT 476** | retouch | 1 | 13 | 7.7 | **SWT 476** | retouch | 1 | 17.6 | 13.5 | 2.4 | 0.4 | 4.2 | **SWT 476** | retouch | 1 | | |
| **SWT 505** | retouch | 5 | 25 | 20.0 | **SWT 505** | retouch | 2 | 27 | 22.5 | 6.1 | 0.3 | 3.3 | **SWT 505** | retouch | | 1 | |
| **SWT 508** | retouch | 2 | 16 | 12.5 | **SWT 508** | retouch | 1 | 39.4 | 34 | 13.4 | 0.1 | 0.7 | **SWT 508** | retouch | | 1 | |
| **SWT 52** | retouch | 6 | 20 | 30.0 | **SWT 52** | retouch | 2 | 30.4 | 27 | 8.2 | 0.2 | 2.4 | **SWT 52** | retouch | | 1 | |
| **SWT 533** | retouch | 9 | 25 | 36.0 | **SWT 533** | retouch | 8 | 43.6 | 41.3 | 18.0 | 0.4 | 4.4 | **SWT 533** | retouch | | 1 | |
| **SWT 589** | retouch | 4 | 14 | 28.6 | **SWT 589** | retouch | 8 | 42.6 | 36.6 | 15.6 | 0.5 | 5.1 | **SWT 589** | retouch | | 1 | |
| **SWT 636** | retouch | 2 | 5 | 40.0 | **SWT 636** | retouch | 2 | 22 | 11.3 | 2.5 | 0.8 | 8.0 | **SWT 636** | retouch | | 1 | |
| **SWT 676** | retouch | 1 | 14 | 7.1 | **SWT 676** | retouch | 1 | 18 | 11.5 | 2.1 | 0.5 | 4.8 | **SWT 676** | retouch | 1 | | |
| **SWT 748** | retouch | 2 | 15 | 13.3 | **SWT 748** | retouch | 1 | 35.3 | 20.7 | 7.3 | 0.1 | 1.4 | **SWT 748** | retouch | 1 | | |
| **SWT 765** | retouch | 0 | 19 | 0.0 | **SWT 765** | retouch | 0 | 39.7 | 22.2 | 8.8 | 0.0 | 0.0 | **SWT 765** | retouch | 1 | | |
| **SWT 767** | retouch | 3 | 17 | 17.6 | **SWT 767** | retouch | 3 | 24 | 13 | 3.1 | 1.0 | 9.6 | **SWT 767** | retouch | | 1 | |
| **SWT 77** | retouch | 2 | 6 | 33.3 | **SWT 77** | retouch | 1 | 60 | 28.6 | 17.2 | 0.1 | 0.6 | **SWT 77** | retouch | | 1 | |
| **SWT 807** | retouch | 3 | 16 | 18.8 | **SWT 807** | retouch | 4 | 24.6 | 13.3 | 3.3 | 1.2 | 12.2 | **SWT 807** | retouch | 1 | | |
| **SWT 831** | retouch | 0 | 1 | 0.0 | **SWT 831** | retouch | 0 | 20 | 12 | 2.4 | 0.0 | 0.0 | **SWT 831** | retouch | | 1 | |
| **SWT 867** | retouch | 0 | 19 | 0.0 | **SWT 867** | retouch | 0 | 35.3 | 24.5 | 8.6 | 0.0 | 0.0 | **SWT 867** | retouch | | 1 | |
| **SWT 880** | retouch | 5 | 12 | 41.7 | **SWT 880** | retouch | 1 | 24.2 | 24.1 | 5.8 | 0.2 | 1.7 | **SWT 880** | retouch | 1 | | |
| **SWT 887** | retouch | 6 | 10 | 60.0 | **SWT 887** | retouch | 2 | 32 | 30 | 9.6 | 0.2 | 2.1 | **SWT 887** | retouch | | 1 | |
| **SWT 888** | retouch | 2 | 6 | 33.3 | **SWT 888** | retouch | 2 | 42.6 | 25.3 | 10.8 | 0.2 | 1.9 | **SWT 888** | retouch | 1 | | |
| **SWT 897** | retouch | 1 | 14 | 7.1 | **SWT 897** | retouch | 4 | 43.6 | 32 | 14.0 | 0.3 | 2.9 | **SWT 897** | retouch | | 1 | |
| **SWT 899** | retouch | 0 | 16 | 0.0 | **SWT 899** | retouch | 0 | 32.3 | 16 | 5.2 | 0.0 | 0.0 | **SWT 899** | retouch | | 1 | |
| **SWT 934** | retouch | 0 | 10 | 0.0 | **SWT 934** | retouch | 1 | 22.7 | 14.3 | 3.2 | 0.3 | 3.1 | **SWT 934** | retouch | | 1 | |
| **SWT 937** | retouch | 5 | 17 | 29.4 | **SWT 937** | retouch | 1 | 32.5 | 27.4 | 8.9 | 0.1 | 1.1 | **SWT 937** | retouch | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SWT 955/6** | retouch | 5 | 16 | 31.3 | **SWT 955/6** | retouch | 1 | 34 | 19.4 | 6.6 | 0.2 | 1.5 | **SWT 955/6** | retouch | | 1 | |
| **SWT 974** | retouch | 3 | 14 | 21.4 | **SWT 974** | retouch | 3 | 33.4 | 21 | 7.0 | 0.4 | 4.3 | **SWT 974** | retouch | | 1 | |
| **SWT 993** | retouch | 2 | 4 | 50.0 | **SWT 993** | retouch | 2 | 22.4 | 13.2 | 3.0 | 0.7 | 6.8 | **SWT 993** | retouch | | 1 | |
| **SWT 494** | Retouch | 0 | 11 | 0.0 | **SWT 494** | Retouch | 2 | 30.7 | 27.8 | 8.5 | 0.2 | 2.3 | **SWT 494** | Retouch | | 1 | |
| **SWT 820** | Retouch | 1 | 10 | 10.0 | **SWT 820** | Retouch | 2 | 31 | 21 | 6.5 | 0.3 | 3.1 | **SWT 820** | Retouch | 1 | | |
| **SWT 812** | Retouch | 0 | 13 | 0.0 | **SWT 812** | Retouch | 0 | 23 | 10.6 | 2.4 | 0.0 | 0.0 | **SWT 812** | Retouch | 1 | | |
| **SWT 1029** | scraper | 3 | 11 | 27.3 | **SWT 1029** | scraper | 1 | 18.4 | 17.2 | 3.2 | 0.3 | 3.2 | **SWT 1029** | scraper | | 1 | |
| **SWT 1136** | scraper | 4 | 14 | 28.6 | **SWT 1136** | scraper | 2 | 23.6 | 20 | 4.7 | 0.4 | 4.2 | **SWT 1136** | scraper | | 1 | |
| **SWT 189** | scraper | 2 | 7 | 28.6 | **SWT 189** | scraper | 4 | 46.5 | 23.5 | 10.9 | 0.4 | 3.7 | **SWT 189** | scraper | | 1 | |
| **SWT 221** | scraper | 5 | 17 | 29.4 | **SWT 221** | scraper | 1 | 30.3 | 23.8 | 7.2 | 0.1 | 1.4 | **SWT 221** | scraper | | 1 | |
| **SWT 245** | scraper | 1 | 13 | 7.7 | **SWT 245** | scraper | 2 | 34.2 | 15.7 | 5.4 | 0.4 | 3.7 | **SWT 245** | scraper | | 1 | |
| **SWT 382** | scraper | 2 | 28 | 7.1 | **SWT 382** | scraper | 3 | 38.9 | 20 | 7.8 | 0.4 | 3.9 | **SWT 382** | scraper | | 1 | |
| **SWT 604** | Scraper | 0 | 8 | 0.0 | **SWT 604** | Scraper | 7 | 26.2 | 23.6 | 6.2 | 1.1 | 11.3 | **SWT 604** | Scraper | 1 | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **274** | | | | 34.9% | **274** | | | | | | | 5.3 | **274** | | 66 | 205 | 3 |
| | | | | | | | | | | | | | | Percentage of sample | 24.1 | 74.8 | 1.1 |

**Table 10: Swartkrans Acheulean quartzite raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **vf** | **f** | **m** | **c** | **vc** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2139 | chopper | 0 | 41 | 0.0 | 2139 | chopper | | | 1 | | | 2139 | chopper | | 1 | |
| 2039 | chopper | 0 | 6 | 0.0 | 2039 | chopper | 1 | | | | | 2039 | chopper | | 1 | |
| sk7996 | chopper | 11 | 29 | 37.9 | sk7996 | chopper | | | 1 | | | sk7996 | chopper | 1 | | |
| sk3961 | chopper core | 1 | 16 | 6.3 | sk3961 | chopper core | | 1 | | | | sk3961 | chopper core | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sk3950 | chopper core | 2 | 24 | 8.3 | sk3950 | chopper core | | | 1 | | | sk3950 | chopper core | 1 | | |
| 3955 | chopper, core | 8 | 25 | 32.0 | 3955 | chopper, core | | | 1 | | | 3955 | chopper, core | | 1 | |
| skx263 | core, cent | 0 | 17 | 0.0 | skx263 | core, cent | | | 1 | | | skx263 | core, cent | 1 | | |
| 3958 | core, chopper, handaxe | 5 | 42 | 11.9 | 3958 | core, chopper, handaxe | | 1 | | | | 3958 | core, chopper, handaxe | 1 | | |
| 3947 | core, flat | 6 | 10 | 60.0 | 3947 | core, flat | | 1 | | | | 3947 | core, flat | 1 | | |
| sk8039 | core, flat, pi | 9 | 30 | 30.0 | sk8039 | core, flat, pi | | | 1 | | | sk8039 | core, flat, pi | 1 | | |
| 34866 | core, p | 0 | 29 | 0.0 | 34866 | core, p | 1 | | | | | 34866 | core, p | 1 | | |
| 3981 | core, p | 9 | 24 | 37.5 | 3981 | core, p | | | 1 | | | 3981 | core, p | | 1 | |
| 31060 | core, pi | 6 | 19 | 31.6 | 31060 | core, pi | | | | | 1 | 31060 | core, pi | | 1 | |
| sk3971 | core, pi | 0 | 23 | 0.0 | sk3971 | core, pi | 1 | | | | | sk3971 | core, pi | 1 | | |
| 3965 | core, pi | 3 | 20 | 15.0 | 3965 | core, pi | | 1 | | | | 3965 | core, pi | | 1 | |
| 12454 | denticulate | 2 | 16 | 12.5 | 12454 | denticulate | | 1 | | | | 12454 | denticulate | 1 | | |
| skx262 | denticulate | 1 | 18 | 5.6 | skx262 | denticulate | | 1 | | | | skx262 | denticulate | 1 | | |
| 19097 | denticulate | 0 | 10 | 0.0 | 19097 | denticulate | | | 1 | | | 19097 | denticulate | | 1 | |
| skx260 | flake | 0 | 5 | 0.0 | skx260 | flake | | 1 | | | | skx260 | flake | 1 | | |
| 31931 | flake | 0 | 1 | 0.0 | 31931 | flake | | 1 | | | | 31931 | flake | 1 | | |
| sk3946 | flake | 0 | 10 | 0.0 | sk3946 | flake | | 1 | | | | sk3946 | flake | 1 | | |
| 31789 | retouch | 2 | 17 | 11.8 | 31789 | retouch | | | 1 | | | 31789 | retouch | | 1 | |
| 17044 | retouch | 1 | 20 | 5.0 | 17044 | retouch | | | | 1 | | 17044 | retouch | 1 | | |
| 19059 | retouch | 5 | 23 | 21.7 | 19059 | retouch | | | 1 | | | 19059 | retouch | 1 | | |
| 19168 | retouch | 0 | 19 | 0.0 | 19168 | retouch | | 1 | | | | 19168 | retouch | 1 | | |
| 2369 | retouch | 4 | 17 | 23.5 | 2369 | retouch | | 1 | | | | 2369 | retouch | | 1 | |
| 2581 | retouch | 5 | 18 | 27.8 | 2581 | retouch | | 1 | | | | 2581 | retouch | | 1 | |
| 1650 | retouch | 5 | 38 | 13.2 | 1650 | retouch | | | 1 | | | 1650 | retouch | 1 | | |
| 25177 | retouch | 3 | 15 | 20.0 | 25177 | retouch | | | 1 | | | 25177 | retouch | 1 | | |
| 33859 | retouch | 2 | 20 | 10.0 | 33859 | retouch | | | 1 | | | 33859 | retouch | 1 | | |
| sk3968 | retouch | 0 | 10 | 0.0 | sk3968 | retouch | | | 1 | | | sk3968 | retouch | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sk3969 | retouch | 1 | 17 | 5.9 | sk3969 | retouch | | | 1 | | | sk3969 | retouch | | 1 | |
| 19053 | scraper | 0 | 21 | 0.0 | 19053 | scraper | | 1 | | | | 19053 | scraper | 1 | | |
| 2367 | scraper | 0 | 16 | 0.0 | 2367 | scraper | | 1 | | | | 2367 | scraper | 1 | | |
| | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **n** | | | | |
| **34** | | | | 12.6% | **34** | | 3 | 14 | 15 | 1 | 1.0 | **34** | | 21 | 13 | 0 |
| | | | | | | Percentage of sample | 8.8 | 41.2 | 44.1 | 2.9 | 2.9 | | Percentage of sample | 61.8 | 38.2 | 0.0 |

**Table 11: Swartkrans Acheulean quartz raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **W, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37101 | chopper core, with retouch | 3 | 16 | 18.8 | 37101 | chopper core, with retouch | 9 | 29.7 | 24.2 | 7.2 | 1.3 | 12.5 | 37101 | chopper core, with retouch | 1 | | |
| 7876 | chopper, core | 0 | 42 | 0.0 | 7876 | chopper, core | 12 | 63.4 | 42.9 | 27.2 | 0.4 | 4.4 | 7876 | chopper, core | 1 | | |
| 19034 | core, casual | 1 | 1 | 100.0 | 19034 | core, casual | 2 | 29.4 | 18.1 | 5.3 | 0.4 | 3.8 | 19034 | core, casual | | 1 | |
| 2033 | core, cent | 4 | 27 | 14.8 | 2033 | core, cent | 9 | 38.8 | 34.4 | 13.3 | 0.7 | 6.7 | 2033 | core, cent | 1 | | |
| 6049 | core, p | 7 | 15 | 46.7 | 6049 | core, p | 10 | 32 | 26.4 | 8.4 | 1.2 | 11.8 | 6049 | core, p | | 1 | |
| 7999 | core, pi | 15 | 38 | 39.5 | 7999 | core, pi | 6 | 41.1 | 28.2 | 11.6 | 0.5 | 5.2 | 7999 | core, pi | 1 | | |
| 24700 | handaxe | 4 | 19 | 21.1 | 24700 | handaxe | 11 | 46.8 | 33 | 15.4 | 0.7 | 7.1 | 24700 | handaxe | 1 | | |
| 3973 | handaxe | 6 | 43 | 14.0 | 3973 | handaxe | 9 | 30.5 | 21 | 6.4 | 1.4 | 14.1 | 3973 | handaxe | 1 | | |
| 25738 | retouch | 0 | 25 | 0.0 | 25738 | retouch | 4 | 22.7 | 22.3 | 5.1 | 0.8 | 7.9 | 25738 | retouch | 1 | | |
| 33918 | retouch | 1 | 12 | 8.3 | 33918 | retouch | 4 | 21.2 | 18.7 | 4.0 | 1.0 | 10.1 | 33918 | retouch | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35899 | retouch | 4 | 9 | 44.4 | 35899 | retouch | 5 | 24.4 | 16 | 3.9 | 1.3 | 12.8 | 35899 | retouch | | 1 | |
| 34942 | retouch | 0 | 18 | 0.0 | 34942 | retouch | 0 | 26.4 | 22.7 | 6.0 | 0.0 | 0.0 | 34942 | retouch | 1 | | |
| 30054 | retouch | 5 | 28 | 17.9 | 30054 | retouch | 10 | 44.2 | 39.1 | 17.3 | 0.6 | 5.8 | 30054 | retouch | 1 | | |
| 2034 | retouch | 1 | 9 | 11.1 | 2034 | retouch | 3 | 31.2 | 22.1 | 6.9 | 0.4 | 4.4 | 2034 | retouch | 1 | | |
| 2638 | retouch | 8 | 42 | 19.0 | 2638 | retouch | 5 | 22.8 | 20 | 4.6 | 1.1 | 11.0 | 2638 | retouch | | 1 | |
| 37915 | scraper | 1 | 13 | 7.7 | 37915 | scraper | 2 | 23.6 | 17.2 | 4.1 | 0.5 | 4.9 | 37915 | scraper | 1 | | |
| 26494 | scraper | 6 | 21 | 28.6 | 26494 | scraper | 5 | 33 | 31.2 | 10.3 | 0.5 | 4.9 | 26494 | scraper | 1 | | |
| 32726 | scraper | 2 | 16 | 12.5 | 32726 | scraper | 10 | 19.2 | 18.5 | 3.6 | 2.8 | 28.2 | 32726 | scraper | | 1 | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **18** | | | | 22.5% | **18** | | | | | | | 8.6 | **18** | | 13 | 5 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 72.2 | 27.8 | 0.0 |

**Table 12: Swartkrans Acheulean quartz raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **w, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27636 | chopper | 9 | 19 | 47.4 | 27636 | chopper | 7 | 39.4 | 54.7 | 21.6 | 0.3 | 3.2 | 27636 | chopper | 1 | | |
| 2193 | chopper | 2 | 15 | 13.3 | 2193 | chopper | 4 | 75.2 | 59.8 | 45.0 | 0.1 | 0.9 | 2193 | chopper | | 1 | |
| 14040 | chopper core | 15 | 34 | 44.1 | 14040 | chopper core | 8 | 73.8 | 71.2 | 52.5 | 0.2 | 1.5 | 14040 | chopper core | | 1 | |
| 35831 | chunk | 4 | 10 | 40.0 | 35831 | chunk | 2 | 30.2 | 12 | 3.6 | 0.6 | 5.5 | 35831 | chunk | | 1 | |
| 28078 | chunk | 2 | 5 | 40.0 | 28078 | chunk | 2 | 24.2 | 22.8 | 5.5 | 0.4 | 3.6 | 28078 | chunk | | 1 | |
| 27989 | chunk | 2 | 8 | 25.0 | 27989 | chunk | 2 | 39.6 | 28.1 | 11.1 | 0.2 | 1.8 | 27989 | chunk | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35649 | chunk | 1 | 3 | 33.3 | 35649 | chunk | 2 | 26.1 | 7.2 | 1.9 | 1.1 | 10.6 | 35649 | chunk | 1 | | |
| 31553 | chunk | 0 | 6 | 0.0 | 31553 | chunk | 1 | 14.5 | 9.4 | 1.4 | 0.7 | 7.3 | 31553 | chunk | 1 | | |
| 25448 | chunk | 4 | 4 | 100.0 | 25448 | chunk | 2 | 17.5 | 16.8 | 2.9 | 0.7 | 6.8 | 25448 | chunk | | 1 | |
| 37183 | chunk | 4 | 4 | 100.0 | 37183 | chunk | 2 | 16.8 | 5.6 | 0.9 | 2.1 | 21.3 | 37183 | chunk | 1 | | |
| 27700 | chunk | 8 | 9 | 88.9 | 27700 | chunk | 5 | 23.2 | 19.8 | 4.6 | 1.1 | 10.9 | 27700 | chunk | | 1 | |
| 32974 | chunk | 1 | 6 | 16.7 | 32974 | chunk | 0 | 22.3 | 18 | 4.0 | 0.0 | 0.0 | 32974 | chunk | 1 | | |
| 35864 | chunk | 0 | 5 | 0.0 | 35864 | chunk | 2 | 18 | 8.9 | 1.6 | 1.2 | 12.5 | 35864 | chunk | | 1 | |
| 36087 | chunk | 0 | 3 | 0.0 | 36087 | chunk | 1 | 22.7 | 5.3 | 1.2 | 0.8 | 8.3 | 36087 | chunk | | 1 | |
| 33984 | chunk | 0 | 4 | 0.0 | 33984 | chunk | 1 | 12.6 | 7.7 | 1.0 | 1.0 | 10.3 | 33984 | chunk | 1 | | |
| 26009 | chunk | 5 | 6 | 83.3 | 26009 | chunk | 3 | 19 | 9 | 1.7 | 1.8 | 17.5 | 26009 | chunk | | 1 | |
| 33789 | chunk | 1 | 2 | 50.0 | 33789 | chunk | 1 | 28 | 7.5 | 2.1 | 0.5 | 4.8 | 33789 | chunk | 1 | | |
| 25306 | cleaver | 10 | 40 | 25.0 | 25306 | cleaver | 2 | 59.2 | 31.1 | 18.4 | 0.1 | 1.1 | 25306 | cleaver | 1 | | |
| 32237 | core, casual | 2 | 3 | 66.7 | 32237 | core, casual | 14 | 50.7 | 49.1 | 24.9 | 0.6 | 5.6 | 32237 | core, casual | 1 | | |
| 33130 | core, casual | 5 | 9 | 55.6 | 33130 | core, casual | 3 | 60.7 | 58 | 35.2 | 0.1 | 0.9 | 33130 | core, casual | 1 | | |
| 29754 | core, casual | 3 | 6 | 50.0 | 29754 | core, casual | 5 | 57.1 | 42 | 24.0 | 0.2 | 2.1 | 29754 | core, casual | | 1 | |
| 29224 | core, casual | 3 | 7 | 42.9 | 29224 | core, casual | 7 | 44 | 39.6 | 17.4 | 0.4 | 4.0 | 29224 | core, casual | | 1 | |
| 29389 | core, flat | 9 | 21 | 42.9 | 29389 | core, flat | 2 | 38.4 | 43.6 | 16.7 | 0.1 | 1.2 | 29389 | core, flat | 1 | | |
| 24702 | core, p | 4 | 17 | 23.5 | 24702 | core, p | 1 | 50.4 | 43.6 | 22.0 | 0.0 | 0.5 | 24702 | core, p | | 1 | |
| 33991 | core, pi | 11 | 14 | 78.6 | 33991 | core, pi | 7 | 55.4 | 34.4 | 19.1 | 0.4 | 3.7 | 33991 | core, pi | | 1 | |
| 27851 | flake | 1 | 2 | 50.0 | 27851 | flake | 3 | 34.2 | 35.4 | 12.1 | 0.2 | 2.5 | 27851 | flake | | 1 | |
| 32849 | flake | 0 | 11 | 0.0 | 32849 | flake | 1 | 38.6 | 18.5 | 7.1 | 0.1 | 1.4 | 32849 | flake | 1 | | |
| 26441 | flake | 1 | 10 | 10.0 | 26441 | flake | 7 | 32 | 17.5 | 5.6 | 1.3 | 12.5 | 26441 | flake | | 1 | |
| 28896 | flake | 0 | 4 | 0.0 | 28896 | flake | 3 | 23.5 | 14.3 | 3.4 | 0.9 | 8.9 | 28896 | flake | 1 | | |
| 32139 | flake | 0 | 3 | 0.0 | 32139 | flake | 0 | 19.2 | 17.4 | 3.3 | 0.0 | 0.0 | 32139 | flake | 1 | | |
| 27826 | flake | 1 | 1 | 100.0 | 27826 | flake | 2 | 20.7 | 16.3 | 3.4 | 0.6 | 5.9 | 27826 | flake | 1 | | |
| 37623 | flake | 1 | 1 | 100.0 | 37623 | flake | 10 | 27 | 21 | 5.7 | 1.8 | 17.6 | 37623 | flake | 1 | | |
| 28008 | flake | 0 | 4 | 0.0 | 28008 | flake | 0 | 21.6 | 19 | 4.1 | 0.0 | 0.0 | 28008 | flake | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32090 | flake | 1 | 3 | 33.3 | 32090 | flake | 0 | 23 | 10.3 | 2.4 | 0.0 | 0.0 | 32090 | flake | 1 | | |
| 22937 | flake | 2 | 3 | 66.7 | 22937 | flake | 3 | 20 | 16.7 | 3.3 | 0.9 | 9.0 | 22937 | flake | | 1 | |
| 22745 | flake | 1 | 1 | 100.0 | 22745 | flake | 3 | 23.3 | 9.9 | 2.3 | 1.3 | 13.0 | 22745 | flake | 1 | | |
| 28608 | flake | 3 | 4 | 75.0 | 28608 | flake | 2 | 20.4 | 11.2 | 2.3 | 0.9 | 8.8 | 28608 | flake | 1 | | |
| 26455 | flake | 0 | 2 | 0.0 | 26455 | flake | 0 | 14.1 | 9 | 1.3 | 0.0 | 0.0 | 26455 | flake | 1 | | |
| 37632 | flake | 1 | 1 | 100.0 | 37632 | flake | 2 | 18.4 | 12.1 | 2.2 | 0.9 | 9.0 | 37632 | flake | | 1 | |
| 26665 | flake | 0 | 3 | 0.0 | 26665 | flake | 0 | 24.7 | 6.8 | 1.7 | 0.0 | 0.0 | 26665 | flake | 1 | | |
| 28252 | flake | 1 | 1 | 100.0 | 28252 | flake | 2 | 27.3 | 7.2 | 2.0 | 1.0 | 10.2 | 28252 | flake | | 1 | |
| 25023 / 25022 | handaxe | 6 | 21 | 28.6 | 25023 | handaxe | 11 | 64.8 | 29.4 | 19.1 | 0.6 | 5.8 | 25023 | handaxe | | 1 | |
| 31725 | handaxe / retouch | 2 | 20 | 10.0 | 31725 | handaxe / retouch | 1 | 102.6 | 95.3 | 97.8 | 0.0 | 0.1 | 31725 | handaxe / retouch | | 1 | |
| 31088 | retouch | 0 | 10 | 0.0 | 31088 | retouch | 6 | 44.4 | 39.2 | 17.4 | 0.3 | 3.4 | 31088 | retouch | | 1 | |
| 28488 | retouch | 1 | 9 | 11.1 | 28488 | retouch | 10 | 44.7 | 30.9 | 13.8 | 0.7 | 7.2 | 28488 | retouch | | 1 | |
| 26937 | retouch | 2 | 19 | 10.5 | 26937 | retouch | 4 | 41.4 | 31.5 | 13.0 | 0.3 | 3.1 | 26937 | retouch | 1 | | |
| 30070 | retouch | 1 | 14 | 7.1 | 30070 | retouch | 6 | 34 | 18.8 | 6.4 | 0.9 | 9.4 | 30070 | retouch | 1 | | |
| 33000 | retouch | 3 | 8 | 37.5 | 33000 | retouch | 8 | 38 | 25.2 | 9.6 | 0.8 | 8.4 | 33000 | retouch | | 1 | |
| 26393 | retouch | 5 | 17 | 29.4 | 26393 | retouch | 12 | 16.3 | 15 | 2.4 | 4.9 | 49.1 | 26393 | retouch | | 1 | |
| 28077 | retouch | 2 | 6 | 33.3 | 28077 | retouch | 2 | 33.7 | 17.2 | 5.8 | 0.3 | 3.5 | 28077 | retouch | 1 | | |
| 28254 | retouch | 0 | 12 | 0.0 | 28254 | retouch | 6 | 24.4 | 21.5 | 5.2 | 1.1 | 11.4 | 28254 | retouch | 1 | | |
| 37673 | retouch | 2 | 12 | 16.7 | 37673 | retouch | 1 | 21.2 | 17.1 | 3.6 | 0.3 | 2.8 | 37673 | retouch | | 1 | |
| 32178 | retouch | 0 | 6 | 0.0 | 32178 | retouch | 0 | 21.7 | 15.7 | 3.4 | 0.0 | 0.0 | 32178 | retouch | | 1 | |
| 30620 | retouch | 1 | 6 | 16.7 | 30620 | retouch | 3 | 22.6 | 11.3 | 2.6 | 1.2 | 11.7 | 30620 | retouch | 1 | | |
| 23315 | retouch | 4 | 10 | 40.0 | 23315 | retouch | 2 | 23.7 | 10.7 | 2.5 | 0.8 | 7.9 | 23315 | retouch | 1 | | |
| 27898 | retouch | 1 | 4 | 25.0 | 27898 | retouch | 1 | 13.2 | 12.6 | 1.7 | 0.6 | 6.0 | 27898 | retouch | | 1 | |
| 33526 | retouch | 0 | 8 | 0.0 | 33526 | retouch | 0 | 15.3 | 9.3 | 1.4 | 0.0 | 0.0 | 33526 | retouch | 1 | | |
| 33807 | retouch | 0 | 8 | 0.0 | 33807 | retouch | 1 | 29.3 | 8.7 | 2.5 | 0.4 | 3.9 | 33807 | retouch | | 1 | |
| 28023 | retouch | 7 | 17 | 41.2 | 28023 | retouch | 13 | 39.5 | 37.3 | 14.7 | 0.9 | 8.8 | 28023 | retouch | | 1 | |
| 36908 | retouch | 8 | 38 | 21.1 | 36908 | retouch | 20 | 49.2 | 47.7 | 23.5 | 0.9 | 8.5 | 36908 | retouch | | 1 | |
| | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **60** | | | | 35.5% | **60** | | | | | | | 6.6 | **60** | | 29 | 31 | 0 |
| | | | | | | | | | | | | | | Percentage of sample | 48.3 | 51.7 | 0.0 |

**Table 13: Experimental Oldowan quartzite raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; g – granules; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **vf** | **f** | **m** | **c** | **vc** | **g** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s36e1 | chopper / core cent | 3 | 19 | 15.8 | s36e1 | chopper / core cent | | | 1 | | | | s36e1 | chopper / core cent | | | 1 |
| 11d4 | chunk | 0 | 4 | 0.0 | 14f5 | chopper core | | 1 | | | | | 14f5 | chopper core | | 1 | |
| 12a3 | chunk | 0 | 11 | 0.0 | 32b10 | chopper core | | 1 | | | | | 32b10 | chopper core | 1 | | |
| 12a4 | chunk | 0 | 6 | 0.0 | 14p1 | chunk | | | | 1 | | | 14p1 | chunk | | | 1 |
| 14h6 | chunk | 0 | 5 | 0.0 | 14p2 | chunk | | | | 1 | | | 14p2 | chunk | | | 1 |
| 21b1 | chunk | 0 | 5 | 0.0 | 21g9 | chunk | | 1 | | | | | 21g9 | chunk | | 1 | |
| 2a4 | chunk | 0 | 8 | 0.0 | 10c7 | chunk | | | 1 | | | | 10c7 | chunk | 1 | | |
| 32b13 | chunk | 0 | 4 | 0.0 | 10f2 | chunk | | 1 | | | | | 10f2 | chunk | | 1 | |
| 5idug4 | chunk | 0 | 4 | 0.0 | 10u1 | chunk | | | 1 | | | | 10u1 | chunk | | 1 | |
| 8L2 | chunk | 0 | 9 | 0.0 | 11d3 | chunk | | | | 1 | | | 11d3 | chunk | | | 1 |
| s46e4 | chunk | 0 | 3 | 0.0 | 11d4 | chunk | | | | 1 | | | 11d4 | chunk | | | 1 |
| S8,O8 | chunk | 0 | 6 | 0.0 | 12a3 | chunk | | | | | 1 | | 12a3 | chunk | | | 1 |
| 12a1 | chunk | 0 | 7 | 0.0 | 12a4 | chunk | | | | | 1 | | 12a4 | chunk | | | 1 |
| 2a2 | chunk | 0 | 6 | 0.0 | 14,O2 | chunk | | 1 | | | | | 14,O2 | chunk | | 1 | |
| 2a5 | chunk | 0 | 5 | 0.0 | 14c2 | chunk | | 1 | | | | | 14c2 | chunk | | | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14h10 | core casual | 0 | 9 | 0.0 | 14d7 | chunk | | 1 | | | | | 14d7 | chunk | | 1 | |
| 14h9 | core, cent | 0 | 20 | 0.0 | 14f1 | chunk | | 1 | | | | | 14f1 | chunk | | 1 | |
| s46e2 | core, cent | 0 | 20 | 0.0 | 14h11 | chunk | | 1 | | | | | 14h11 | chunk | | | 1 |
| 14w3 | core, pi | 0 | 11 | 0.0 | 14h6 | chunk | | 1 | | | | | 14h6 | chunk | | | 1 |
| 21g8 | denticulate | 0 | 12 | 0.0 | 14n1 | chunk | | | 1 | | | | 14n1 | chunk | | | 1 |
| 21c8 | denticulate | 0 | 10 | 0 | 14n4 | chunk | | | 1 | | | | 14n4 | chunk | | | 1 |
| 34c2 | denticulate | 0 | 9 | 0.0 | 14q3 | chunk | | 1 | | | | | 14q3 | chunk | | 1 | |
| s46e7 | denticulate | 0 | 17 | 0.0 | 14s2 | chunk | | 1 | | | | | 14s2 | chunk | | | 1 |
| S8.O6 | denticulate | 0 | 16 | 0.0 | 14s3 | chunk | | 1 | | | | | 14s3 | chunk | | | 1 |
| 10c6 | flake | 0 | 1 | 0.0 | 14t1 | chunk | | | 1 | | | | 14t1 | chunk | | | 1 |
| 12a5 | flake | 0 | 5 | 0.0 | 14u3 | chunk | | | 1 | | | | 14u3 | chunk | | | 1 |
| 14f3 | flake | 0 | 7 | 0.0 | 14u5 | chunk | | | 1 | | | | 14u5 | chunk | | | 1 |
| 14h1 | flake | 0 | 3 | 0.0 | 20aj4 | chunk | | 1 | | | | | 20aj4 | chunk | | 1 | |
| 14h4 | flake | 0 | 3 | 0.0 | 20ak1 | chunk | | | 1 | | | | 20ak1 | chunk | | 1 | |
| 14v2 | flake | 0 | 1 | 0.0 | 20t2 | chunk | | | | 1 | | | 20t2 | chunk | | 1 | |
| 21c4 | flake | 0 | 2 | 0.0 | 21b1 | chunk | | | | 1 | | | 21b1 | chunk | | | 1 |
| 21L9 | flake | 0 | 4 | 0.0 | 21c7 | chunk | | 1 | | | | | 21c7 | chunk | | 1 | |
| 2a1 | flake | 0 | 3 | 0.0 | 21h2 | chunk | | 1 | | | | | 21h2 | chunk | | 1 | |
| 32b2 | flake | 0 | 7 | 0.0 | 21L11 | chunk | | 1 | | | | | 21L11 | chunk | | 1 | |
| 32c1 | flake | 0 | 3 | 0.0 | 2a4 | chunk | | | | 1 | | | 2a4 | chunk | | | 1 |
| 33a3 | flake | 0 | 5 | 0.0 | 2a7 | chunk | | | | 1 | | | 2a7 | chunk | | | 1 |
| 36a2 | flake | 0 | 7 | 0.0 | 31a2 | chunk | | 1 | | | | | 31a2 | chunk | | 1 | |
| 36d2 | flake | 0 | 2 | 0.0 | 32b12 | chunk | | 1 | | | | | 32b12 | chunk | 1 | | |
| 46c2 | flake | 0 | 5 | 0.0 | 32b13 | chunk | | 1 | | | | | 32b13 | chunk | 1 | | |
| 5asurf2 | flake | 0 | 10 | 0.0 | 32c4 | chunk | | | | | | 1 | 32c4 | chunk | | | 1 |
| 5bsurf1 | flake | 0 | 8 | 0.0 | 32c6 | chunk | | | | | | 1 | 32c6 | chunk | | | 1 |
| 5bsurf8 | flake | 0 | 18 | 0.0 | 34c3 | chunk | | 1 | | | | | 34c3 | chunk | | 1 | |
| 5r2 | flake | 0 | 9 | 0.0 | 36a3 | chunk | | | 1 | | | | 36a3 | chunk | 1 | | |
| 8L1 | flake | 0 | 4 | 0.0 | 36d3 | chunk | | | 1 | | | | 36d3 | chunk | | | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8L6 | flake | 0 | 9 | 0.0 | 37a5 | chunk | | | 1 | | | | 37a5 | chunk | | 1 | |
| 8m1 | flake | 0 | 4 | 0.0 | 37d2 | chunk | | | | | 1 | | 37d2 | chunk | | | 1 |
| s46e3 | flake | 0 | 7 | 0.0 | 46a3 | chunk | | 1 | | | | | 46a3 | chunk | | 1 | |
| S8,O1 | flake | 0 | 8 | 0.0 | 46b4 | chunk | | 1 | | | | | 46b4 | chunk | | 1 | |
| 11d2 | flake | 0 | 6 | 0.0 | 46d1 | chunk | | 1 | | | | | 46d1 | chunk | | | 1 |
| 11d5 | flake | 0 | 4 | 0.0 | 5asurf12 | chunk | | | 1 | | | | 5asurf12 | chunk | | 1 | |
| 12a7 | flake | 0 | 4 | 0.0 | 5asurf8 | chunk | | | 1 | | | | 5asurf8 | chunk | | 1 | |
| 14h2 | flake | 0 | 4 | 0.0 | 5bsurf13 | chunk | | 1 | | | | | 5bsurf13 | chunk | 1 | | |
| 14h5 | flake | 0 | 3 | 0.0 | 5bsurf6 | chunk | | 1 | | | | | 5bsurf6 | chunk | 1 | | |
| 14u1 | flake | 0 | 1 | 0.0 | 5ddug2 | chunk | | | | 1 | | | 5ddug2 | chunk | | | 1 |
| 14w2 | flake | 0 | 3 | 0.0 | 5ddug3 | chunk | | | | 1 | | | 5ddug3 | chunk | | | 1 |
| 21c1 | flake | 0 | 5 | 0.0 | 5gsurf6 | chunk | | 1 | | | | | 5gsurf6 | chunk | | 1 | |
| 21L1 | flake | 0 | 8 | 0.0 | 5idug1 | chunk | | 1 | | | | | 5idug1 | chunk | | 1 | |
| 21L2 | flake | 0 | 3 | 0.0 | 5idug4 | chunk | | 1 | | | | | 5idug4 | chunk | | 1 | |
| 21L4 | flake | 0 | 1 | 0.0 | 5mdug1 | chunk | | | 1 | | | | 5mdug1 | chunk | | 1 | |
| 21L5 | flake | 0 | 7 | 0.0 | 5Odug4 | chunk | | | 1 | | | | 5Odug4 | chunk | | | 1 |
| 2a3 | flake | 0 | 6 | 0.0 | 5Odug5 | chunk | | | 1 | | | | 5Odug5 | chunk | | | 1 |
| 32c3 | flake | 0 | 3 | 0.0 | 5qdug7 | chunk | | | 1 | | | | 5qdug7 | chunk | | 1 | |
| 33a1 | flake | 0 | 6 | 0.0 | 6a4 | chunk | | 1 | | | | | 6a4 | chunk | | 1 | |
| 5asurf4 | flake | 0 | 10 | 0.0 | 6d6 | chunk | | | 1 | | | | 6d6 | chunk | | 1 | |
| 5bsurf2 | flake | 0 | 8 | 0.0 | 8i6 | chunk | | | 1 | | | | 8i6 | chunk | | 1 | |
| 11d12 | retouch | 0 | 8 | 0.0 | 8L2 | chunk | | | 1 | | | | 8L2 | chunk | | 1 | |
| 14h7 | retouch | 0 | 9 | 0.0 | 8L8 | chunk | | | 1 | | | | 8L8 | chunk | | 1 | |
| 14h8 | retouch | 0 | 9 | 0.0 | 8m6 | chunk | | | 1 | | | | 8m6 | chunk | | 1 | |
| 21L6 | retouch | 0 | 14 | 0.0 | 8n7 | chunk | | | 1 | | | | 8n7 | chunk | | 1 | |
| 2a8 | retouch | 0 | 10 | 0.0 | 8v2 | chunk | | 1 | | | | | 8v2 | chunk | | 1 | |
| 32b4 | retouch | 0 | 22 | 0.0 | S10,O12 | chunk | | 1 | | | | | S10,O12 | chunk | | 1 | |
| 36d1 | retouch | 0 | 10 | 0.0 | S10,O2 | chunk | | 1 | | | | | S10,O2 | chunk | | 1 | |
| 5asurf6 | retouch | 0 | 27 | 0.0 | 14c1 | chunk | | 1 | | | | | 14c1 | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5bsurf7 | retouch | 0 | 14 | 0.0 | 14c7 | chunk | | 1 | | | | | 14c7 | chunk | | 1 | |
| s46e5 | retouch | 0 | 15 | 0.0 | s37e3 | chunk | | | 1 | | | | s37e3 | chunk | | | 1 |
| 12a6 | scraper | 0 | 5 | 0.0 | s46e4 | chunk | | 1 | | | | | s46e4 | chunk | | 1 | |
| 32b6 | scraper | 0 | 9 | 0.0 | S8,O8 | chunk | | | 1 | | | | S8,O8 | chunk | 1 | | |
| 36a4 | scraper | 0 | 17 | 0.0 | 12a1 | chunk | | | | | 1 | | 12a1 | chunk | | | 1 |
| 5asurf1 | scraper | 0 | 20 | 0.0 | 2a2 | chunk | | | | 1 | | | 2a2 | chunk | | | 1 |
| 5jsurf1 | scraper | 0 | 13 | 0.0 | 2a5 | chunk | | | | 1 | | | 2a5 | chunk | | | 1 |
| 5Ldug4 | scraper | 0 | 14 | 0.0 | 2a6 | chunk | | | | 1 | | | 2a6 | chunk | | | 1 |
| 5mdug3 | scraper | 0 | 20 | 0.0 | 5ddug1 | chunk | | | | 1 | | | 5ddug1 | chunk | | | 1 |
| 8L3 | scraper | 0 | 7 | 0.0 | 7a1 | chunk | | 1 | | | | | 7a1 | chunk | | 1 | |
| s46e6 | scraper | 0 | 22 | 0.0 | 14j3 | cleaver / chopper | | | 1 | | | | 14j3 | cleaver / chopper | | | 1 |
| S8,O2 | scraper | 0 | 37 | 0.0 | 14h10 | core casual | | 1 | | | | | 14h10 | core casual | | | 1 |
| 10f6 | scraper | 1 | 36 | 2.8 | 14c10 | core chunk | | 1 | | | | | 14c10 | core chunk | | 1 | |
| S10e4 | core, cent / handaxe | 1 | 31 | 3.2 | 14c9 | core chunk | | 1 | | | | | 14c9 | core chunk | | 1 | |
| S8,O4 | core, flat | 1 | 27 | 3.7 | 10u3 | core, cent | | | 1 | | | | 10u3 | core, cent | | 1 | |
| 21L8 | scraper | 1 | 25 | 4.0 | 14h9 | core, cent | | 1 | | | | | 14h9 | core, cent | | | 1 |
| 5Ldug2 | core, pi | 1 | 24 | 4.2 | 20ak5 | core, cent | | | 1 | | | | 20ak5 | core, cent | | 1 | |
| 14f6 | denticulate | 1 | 18 | 5.6 | 21c9 | core, cent | | 1 | | | | | 21c9 | core, cent | | 1 | |
| 21c5 | scraper | 1 | 18 | 5.6 | 21L10 | core, cent | | 1 | | | | | 21L10 | core, cent | 1 | | |
| 5gsurf1 | scraper | 1 | 17 | 5.9 | 32b11 | core, cent | | 1 | | | | | 32b11 | core, cent | 1 | | |
| 12a10 | core, pi | 1 | 16 | 6.3 | 33a4 | core, cent | | | 1 | | | | 33a4 | core, cent | | 1 | |
| 21c6 | retouch | 1 | 16 | 6.3 | 37d4 | core, cent | | | | | 1 | | 37d4 | core, cent | | | 1 |
| 33a2 | retouch | 1 | 16 | 6.3 | 46a1 | core, cent | | 1 | | | | | 46a1 | core, cent | | 1 | |
| 8L9 | core, pi | 1 | 15 | 6.7 | 5gsurf3 | core, cent | | 1 | | | | | 5gsurf3 | core, cent | 1 | | |
| 32b10 | chopper core | 1 | 14 | 7.1 | 5Odug6 | core, cent | | | 1 | | | | 5Odug6 | core, cent | | | 1 |
| 5bsurf5 | core, flat | 2 | 27 | 7.4 | 5pdug4 | core, cent | | | 1 | | | | 5pdug4 | core, cent | | | 1 |
| 12a9 | core, frag | 1 | 13 | 7.7 | 5pdug8 | core, cent | | 1 | | | | | 5pdug8 | core, cent | | | 1 |
| 11d11 | scraper | 1 | 13 | 7.7 | 6d4 | core, cent | | | 1 | | | | 6d4 | core, cent | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14n11 | scraper | 1 | 13 | 7.7 | s46e2 | core, cent | | 1 | | | | | s46e2 | core, cent | 1 | | |
| 5Ldug1 | retouch | 1 | 12 | 8.3 | 20au3 | core, cent | | | 1 | | | | 20au3 | core, cent | | | 1 |
| 5asurf7 | scraper | 1 | 12 | 8.3 | 14t3 | core, cent / chopper | | | 1 | | | | 14t3 | core, cent / chopper | | | 1 |
| 5pdug2 | scraper | 1 | 12 | 8.3 | S10e4 | core, cent / handaxe | | | | 1 | | | S10e4 | core, cent / handaxe | | 1 | |
| 10c2 | retouch | 2 | 22 | 9.1 | 10a1 | core, disc/prep | | | 1 | | | | 10a1 | core, disc/prep | 1 | | |
| 10c3 | retouch | 2 | 22 | 9.1 | 21h5 | core, flat | | 1 | | | | | 21h5 | core, flat | | 1 | |
| 14q2 | retouch | 1 | 11 | 9.1 | 32d2 | core, flat | | 1 | | | | | 32d2 | core, flat | | | 1 |
| 5dsurf2 | retouch | 1 | 11 | 9.1 | 46b2 | core, flat | | 1 | | | | | 46b2 | core, flat | | 1 | |
| 7a4 | retouch | 1 | 11 | 9.1 | 46c1 | core, flat | | 1 | | | | | 46c1 | core, flat | | 1 | |
| 46b6 | scraper | 2 | 21 | 9.5 | 5bsurf5 | core, flat | | 1 | | | | | 5bsurf5 | core, flat | 1 | | |
| 21f2 | flake | 1 | 10 | 10.0 | s37e5 | core, flat | | | 1 | | | | s37e5 | core, flat | | | 1 |
| 5bsurf4 | scraper | 2 | 20 | 10.0 | S8,O4 | core, flat | | | 1 | | | | S8,O4 | core, flat | | 1 | |
| 5pdug7 | retouch | 2 | 19 | 10.5 | 10f5 | core, flat/p | | 1 | | | | | 10f5 | core, flat/p | | 1 | |
| 14n7 | retouch | 1 | 9 | 11.1 | 31a3 | core, flat/prep | | 1 | | | | | 31a3 | core, flat/prep | | 1 | |
| 14v3 | retouch | 1 | 9 | 11.1 | 12a9 | core, frag | | | 1 | | | | 12a9 | core, frag | | | 1 |
| 5r1 | scraper | 1 | 9 | 11.1 | 20au2 | core, frag | | | 1 | | | | 20au2 | core, frag | | | 1 |
| 21f1 | scraper | 1 | 9 | 11.1 | 5ddug4 | core, frag | | | | 1 | | | 5ddug4 | core, frag | | | 1 |
| 10a2 | scraper | 5 | 44 | 11.4 | 5mdug4 | core, frag | | | 1 | | | | 5mdug4 | core, frag | | 1 | |
| 36c3 | retouch | 5 | 41 | 12.2 | 8i3 | core, frag | | | 1 | | | | 8i3 | core, frag | | 1 | |
| 14s2 | chunk | 1 | 8 | 12.5 | 11d10 | core, p | | | | 1 | | | 11d10 | core, p | | | 1 |
| 2a7 | chunk | 1 | 8 | 12.5 | 11d9 | core, p | | | | 1 | | | 11d9 | core, p | | | 1 |
| 2a6 | chunk | 1 | 8 | 12.5 | 20aj2 | core, p | | 1 | | | | | 20aj2 | core, p | | 1 | |
| 21L7 | denticulate | 1 | 8 | 12.5 | 21b10 | core, p | | | | 1 | | | 21b10 | core, p | | 1 | |
| 33a4 | denticulate | 3 | 24 | 12.5 | 32c10 | core, p | | | | | | 1 | 32c10 | core, p | | | 1 |
| 12a8 | flake | 1 | 8 | 12.5 | 5asurf13 | core, p | | | 1 | | | | 5asurf13 | core, p | | 1 | |
| 14v1 | flake | 1 | 8 | 12.5 | 5asurf9 | core, p | | | 1 | | | | 5asurf9 | core, p | | 1 | |
| 32c7 | flake | 1 | 8 | 12.5 | 5dsurf4 | core, p | | | | 1 | | | 5dsurf4 | core, p | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S10,O8 | retouch | 2 | 16 | 12.5 | 5esurf3 | core, p | | | | 1 | | | 5esurf3 | core, p | | | 1 |
| s36e2 | scraper | 1 | 8 | 12.5 | 5fsurf2 | core, p | | 1 | | | | | 5fsurf2 | core, p | | 1 | |
| 37a4 | retouch | 2 | 15 | 13.3 | 5Odug8 | core, p | | | 1 | | | | 5Odug8 | core, p | | | 1 |
| 5qdug1 | scraper | 3 | 22 | 13.6 | 5qdug3 | core, p | | | 1 | | | | 5qdug3 | core, p | | 1 | |
| 32c6 | chunk | 1 | 7 | 14.3 | 8L10 | core, p | | | 1 | | | | 8L10 | core, p | | 1 | |
| 14d6 | denticulate | 2 | 14 | 14.3 | 8n2 | core, p | | | 1 | | | | 8n2 | core, p | | 1 | |
| 32c2 | flake | 1 | 7 | 14.3 | 8n5 | core, p | | | 1 | | | | 8n5 | core, p | | 1 | |
| S10e2 | flake | 1 | 7 | 14.3 | 8v4 | core, p | | 1 | | | | | 8v4 | core, p | | 1 | |
| 32c5 | flake | 1 | 7 | 14.3 | 6a3 | core, p | | 1 | | | | | 6a3 | core, p | | 1 | |
| 5fsurf5 | retouch | 2 | 14 | 14.3 | 21g10 | core, pi | | 1 | | | | | 21g10 | core, pi | | 1 | |
| 8L11 | retouch | 4 | 27 | 14.8 | 10c4 | core, pi | | | | 1 | | | 10c4 | core, pi | | 1 | |
| 5qdug3 | core, p | 5 | 33 | 15.2 | 12a10 | core, pi | | | | 1 | | | 12a10 | core, pi | | | 1 |
| 46a5 | scraper | 2 | 13 | 15.4 | 14n10 | core, pi | | | 1 | | | | 14n10 | core, pi | | | 1 |
| 5gsurf3 | core, cent | 5 | 32 | 15.6 | 14w3 | core, pi | | | 1 | | | | 14w3 | core, pi | | | 1 |
| 11d9 | core, p | 3 | 19 | 15.8 | 37a7 | core, pi | | | 1 | | | | 37a7 | core, pi | | 1 | |
| 32c10 | core, p | 3 | 19 | 15.8 | 5ddug5 | core, pi | | | | 1 | | | 5ddug5 | core, pi | | | 1 |
| 5pdug1 | retouch | 3 | 19 | 15.8 | 5Ldug2 | core, pi | | | 1 | | | | 5Ldug2 | core, pi | | | 1 |
| 6a3 | retouch | 3 | 19 | 15.8 | 5r3 | core, pi | | 1 | | | | | 5r3 | core, pi | | | 1 |
| 11d3 | chunk | 1 | 6 | 16.7 | 7a3 | core, pi | | 1 | | | | | 7a3 | core, pi | | 1 | |
| 14n1 | chunk | 1 | 6 | 16.7 | 8i5 | core, pi | | | 1 | | | | 8i5 | core, pi | | 1 | |
| 21h2 | chunk | 1 | 6 | 16.7 | 8L9 | core, pi | | | 1 | | | | 8L9 | core, pi | | 1 | |
| 21L10 | core, cent | 4 | 24 | 16.7 | S10,O10 | core, pi | | 1 | | | | | S10,O10 | core, pi | | 1 | |
| 32b5 | flake | 1 | 6 | 16.7 | 14,O3 | core, pi | | 1 | | | | | 14,O3 | core, pi | | 1 | |
| 34c4 | retouch | 3 | 18 | 16.7 | 21g8 | denticulate | | 1 | | | | | 21g8 | denticulate | | 1 | |
| 21f3 | scraper | 2 | 12 | 16.7 | 10d1 | denticulate | | | 1 | | | | 10d1 | denticulate | | 1 | |
| 5asurf9 | core, p | 7 | 41 | 17.1 | 14,O1 | denticulate | | 1 | | | | | 14,O1 | denticulate | | 1 | |
| 37a2 | scraper | 5 | 29 | 17.2 | 14d6 | denticulate | | 1 | | | | | 14d6 | denticulate | | 1 | |
| 20au3 | core, cent | 3 | 17 | 17.6 | 14f6 | denticulate | | 1 | | | | | 14f6 | denticulate | | 1 | |
| 46a6 | denticulate | 3 | 17 | 17.6 | 20ak7 | denticulate | | | 1 | | | | 20ak7 | denticulate | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21c9 | core, cent | 5 | 28 | 17.9 | 21c8 | denticulate | | 1 | | | | | 21c8 | denticulate | | 1 | |
| 5bsurf9 | denticulate | 2 | 11 | 18.2 | 21L7 | denticulate | | 1 | | | | | 21L7 | denticulate | | 1 | |
| 14j2 | retouch | 2 | 11 | 18.2 | 33a4 | denticulate | | 1 | | | | | 33a4 | denticulate | | 1 | |
| 32d4 | retouch | 4 | 22 | 18.2 | 34c2 | denticulate | | 1 | | | | | 34c2 | denticulate | | 1 | |
| 37a3 | retouch | 4 | 22 | 18.2 | 36a1 | denticulate | | | 1 | | | | 36a1 | denticulate | 1 | | |
| 8L5 | scraper | 2 | 11 | 18.2 | 37a1 | denticulate | | | 1 | | | | 37a1 | denticulate | 1 | | |
| 14f7 | retouch | 3 | 16 | 18.8 | 46a6 | denticulate | | 1 | | | | | 46a6 | denticulate | | 1 | |
| S14e11 | retouch | 3 | 16 | 18.8 | 46b7 | denticulate | | 1 | | | | | 46b7 | denticulate | | 1 | |
| 10a5 | retouch | 4 | 21 | 19.0 | 46c4 | denticulate | | 1 | | | | | 46c4 | denticulate | | | 1 |
| 14f4 | scraper | 4 | 21 | 19.0 | 5asurf5 | denticulate | | | 1 | | | | 5asurf5 | denticulate | | 1 | |
| 14h11 | chunk | 1 | 5 | 20.0 | 5bsurf11 | denticulate | | 1 | | | | | 5bsurf11 | denticulate | 1 | | |
| 36d3 | chunk | 1 | 5 | 20.0 | 5bsurf9 | denticulate | | 1 | | | | | 5bsurf9 | denticulate | 1 | | |
| 46b4 | chunk | 1 | 5 | 20.0 | 5dsurf5 | denticulate | | | | 1 | | | 5dsurf5 | denticulate | | | 1 |
| 37a1 | denticulate | 3 | 15 | 20.0 | 5gsurf5 | denticulate | | 1 | | | | | 5gsurf5 | denticulate | | 1 | |
| 5bsurf11 | denticulate | 2 | 10 | 20.0 | 5idug11 | denticulate | | 1 | | | | | 5idug11 | denticulate | | 1 | |
| S10,O6 | denticulate | 3 | 15 | 20.0 | 5qdug6 | denticulate | | | 1 | | | | 5qdug6 | denticulate | | 1 | |
| 11d6 | flake | 1 | 5 | 20.0 | 8m4 | denticulate | | | 1 | | | | 8m4 | denticulate | | 1 | |
| 5idug3 | flake | 1 | 5 | 20.0 | S10,O3 | denticulate | | 1 | | | | | S10,O3 | denticulate | | 1 | |
| 8i1 | flake | 2 | 10 | 20.0 | S10,O6 | denticulate | | 1 | | | | | S10,O6 | denticulate | 1 | | |
| 14h3 | flake | 1 | 5 | 20.0 | S10e3 | denticulate | | | 1 | | | | S10e3 | denticulate | | 1 | |
| 46d2 | retouch | 3 | 15 | 20.0 | s37e1 | denticulate | | | 1 | | | | s37e1 | denticulate | | 1 | |
| 21g5 | scraper | 3 | 15 | 20.0 | s46e7 | denticulate | | 1 | | | | | s46e7 | denticulate | | 1 | |
| 14n9 | scraper | 4 | 20 | 20.0 | S8.O6 | denticulate | | | 1 | | | | S8.O6 | denticulate | 1 | | |
| 32b9 | scraper | 3 | 15 | 20.0 | 5jsurf3 | denticulate | | | 1 | | | | 5jsurf3 | denticulate | | 1 | |
| 5bsurf12 | scraper | 5 | 25 | 20.0 | 21g7 | flake | | 1 | | | | | 21g7 | flake | 1 | | |
| 21h3 | scraper | 1 | 5 | 20.0 | 10a3 | flake | | | 1 | | | | 10a3 | flake | 1 | | |
| 5qdug2 | scraper | 6 | 29 | 20.7 | 10c6 | flake | | | 1 | | | | 10c6 | flake | | 1 | |
| 5gsurf5 | denticulate | 5 | 24 | 20.8 | 10d4 | flake | | | 1 | | | | 10d4 | flake | | 1 | |
| 31a4 | retouch | 5 | 24 | 20.8 | 10f1 | flake | | 1 | | | | | 10f1 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S10e3 | denticulate | 4 | 19 | 21.1 | 11d1 | flake | | | | 1 | | | 11d1 | flake | | | 1 |
| 21h4 | retouch | 3 | 14 | 21.4 | 11d6 | flake | | | | 1 | | | 11d6 | flake | | | 1 |
| 32d1 | retouch | 3 | 14 | 21.4 | 12a2 | flake | | | | | 1 | | 12a2 | flake | | | 1 |
| 8n1 | retouch | 3 | 14 | 21.4 | 12a5 | flake | | | 1 | | | | 12a5 | flake | | | 1 |
| 14p3 | scraper | 3 | 14 | 21.4 | 14c1 | flake | | 1 | | | | | 14c1 | flake | | | 1 |
| 11d7 | scraper | 3 | 14 | 21.4 | 14c3 | flake | | 1 | | | | | 14c3 | flake | | | 1 |
| 20ak6 | retouch | 2 | 9 | 22.2 | 14d1 | flake | | 1 | | | | | 14d1 | flake | | 1 | |
| 5idug8 | retouch | 2 | 9 | 22.2 | 14d3 | flake | | 1 | | | | | 14d3 | flake | | 1 | |
| 20ak4 | scraper | 4 | 18 | 22.2 | 14f3 | flake | | 1 | | | | | 14f3 | flake | | 1 | |
| 7a2 | scraper | 4 | 18 | 22.2 | 14h1 | flake | | 1 | | | | | 14h1 | flake | | | 1 |
| 10u3 | core, cent | 5 | 22 | 22.7 | 14h4 | flake | | 1 | | | | | 14h4 | flake | | | 1 |
| 11d10 | core, p | 5 | 22 | 22.7 | 14j1 | flake | | | 1 | | | | 14j1 | flake | | | 1 |
| 10c4 | core, pi | 5 | 22 | 22.7 | 14n2 | flake | | | 1 | | | | 14n2 | flake | | | 1 |
| 8L10 | core, p | 6 | 26 | 23.1 | 14n3 | flake | | | 1 | | | | 14n3 | flake | | | 1 |
| S10,O3 | denticulate | 3 | 13 | 23.1 | 14u4 | flake | | | 1 | | | | 14u4 | flake | | | 1 |
| 14n6 | retouch | 3 | 13 | 23.1 | 14v2 | flake | | | 1 | | | | 14v2 | flake | | 1 | |
| 8n2 | core, p | 5 | 21 | 23.8 | 14v4 | flake | | | 1 | | | | 14v4 | flake | | 1 | |
| 14n4 | chunk | 1 | 4 | 25.0 | 20ak3 | flake | | | 1 | | | | 20ak3 | flake | | 1 | |
| 5ddug1 | chunk | 1 | 4 | 25.0 | 21b5 | flake | | | | 1 | | | 21b5 | flake | | 1 | |
| 33a4 | core, cent | 7 | 28 | 25.0 | 21c4 | flake | | 1 | | | | | 21c4 | flake | | 1 | |
| 46b7 | denticulate | 3 | 12 | 25.0 | 21f2 | flake | | | 1 | | | | 21f2 | flake | | 1 | |
| 5dsurf5 | denticulate | 4 | 16 | 25.0 | 21L9 | flake | | 1 | | | | | 21L9 | flake | 1 | | |
| 11d1 | flake | 1 | 4 | 25.0 | 2a1 | flake | | | | 1 | | | 2a1 | flake | | | 1 |
| 12a2 | flake | 1 | 4 | 25.0 | 2a9 | flake | | | | 1 | | | 2a9 | flake | | | 1 |
| 14c1 | flake | 1 | 4 | 25.0 | 31a4 | flake | | 1 | | | | | 31a4 | flake | | 1 | |
| 14n2 | flake | 1 | 4 | 25.0 | 32b2 | flake | | 1 | | | | | 32b2 | flake | 1 | | |
| 2a9 | flake | 1 | 4 | 25.0 | 32b5 | flake | | 1 | | | | | 32b5 | flake | 1 | | |
| 5asurf3 | flake | 2 | 8 | 25.0 | 32c1 | flake | | | | | | 1 | 32c1 | flake | | | 1 |
| 5mdug2 | flake | 1 | 4 | 25.0 | 32c2 | flake | | | | | | 1 | 32c2 | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21g1 | flake | 1 | 4 | 25.0 | 33a3 | flake | | | 1 | | | | 33a3 | flake | | 1 | |
| 14n5 | flake | 1 | 4 | 25.0 | 34c1 | flake | | 1 | | | | | 34c1 | flake | | 1 | |
| 14s1 | flake | 1 | 4 | 25.0 | 36a2 | flake | | | 1 | | | | 36a2 | flake | 1 | | |
| 14w1 | flake | 1 | 4 | 25.0 | 36d2 | flake | | | 1 | | | | 36d2 | flake | | | 1 |
| 21b7 | retouch | 6 | 24 | 25.0 | 37a6 | flake | | | 1 | | | | 37a6 | flake | | 1 | |
| 5bsurf14 | retouch | 4 | 16 | 25.0 | 37d3 | flake | | | | | 1 | | 37d3 | flake | | | 1 |
| 5qdug8 | retouch | 3 | 12 | 25.0 | 46a2 | flake | | 1 | | | | | 46a2 | flake | | 1 | |
| 21c3 | retouch | 1 | 4 | 25 | 46b3 | flake | | 1 | | | | | 46b3 | flake | | 1 | |
| 20aj1 | scraper | 7 | 28 | 25.0 | 46c2 | flake | | 1 | | | | | 46c2 | flake | | 1 | |
| 5r3 | core, pi | 4 | 15 | 26.7 | 5asurf2 | flake | | | 1 | | | | 5asurf2 | flake | | 1 | |
| 21g6 | retouch | 4 | 15 | 26.7 | 5asurf3 | flake | | | 1 | | | | 5asurf3 | flake | 1 | | |
| 5idug9 | retouch | 4 | 15 | 26.7 | 5bsurf1 | flake | | 1 | | | | | 5bsurf1 | flake | 1 | | |
| 5idug12 | scraper | 4 | 15 | 26.7 | 5bsurf8 | flake | | 1 | | | | | 5bsurf8 | flake | 1 | | |
| 8i3 | core, frag | 3 | 11 | 27.3 | 5esurf1 | flake | | | | 1 | | | 5esurf1 | flake | | | 1 |
| 5idug11 | denticulate | 3 | 11 | 27.3 | 5esurf2 | flake | | | | 1 | | | 5esurf2 | flake | | | 1 |
| 46b5 | retouch | 3 | 11 | 27.3 | 5fsurf4 | flake | | 1 | | | | | 5fsurf4 | flake | | 1 | |
| 46c4 | denticulate | 4 | 14 | 28.6 | 5idug3 | flake | | 1 | | | | | 5idug3 | flake | | 1 | |
| 20t4 | retouch | 4 | 14 | 28.6 | 5idug7 | flake | | 1 | | | | | 5idug7 | flake | | 1 | |
| 32b8 | retouch | 6 | 21 | 28.6 | 5mdug2 | flake | | | 1 | | | | 5mdug2 | flake | | 1 | |
| 6d7 | retouch | 8 | 28 | 28.6 | 5Odug10 | flake | | | 1 | | | | 5Odug10 | flake | | | 1 |
| 8L7 | retouch | 4 | 14 | 28.6 | 5Odug9 | flake | | | 1 | | | | 5Odug9 | flake | | | 1 |
| 31a1 | scraper | 6 | 21 | 28.6 | 5r2 | flake | | 1 | | | | | 5r2 | flake | | | 1 |
| 46c1 | core, flat | 7 | 24 | 29.2 | 6d2 | flake | | | 1 | | | | 6d2 | flake | | 1 | |
| 20aj2 | core, p | 10 | 34 | 29.4 | 8i1 | flake | | | 1 | | | | 8i1 | flake | | 1 | |
| 46a4 | retouch | 5 | 17 | 29.4 | 8L1 | flake | | | 1 | | | | 8L1 | flake | | 1 | |
| 10u2 | scraper | 5 | 17 | 29.4 | 8L6 | flake | | | 1 | | | | 8L6 | flake | | 1 | |
| S14e4 | retouch | 3 | 10 | 30.0 | 8m1 | flake | | | 1 | | | | 8m1 | flake | | 1 | |
| 14f2 | retouch | 4 | 13 | 30.8 | 8m5 | flake | | | 1 | | | | 8m5 | flake | | 1 | |
| 20t3 | scraper | 4 | 13 | 30.8 | 8v1 | flake | | 1 | | | | | 8v1 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32b11 | core, cent | 5 | 16 | 31.3 | S10,O5 | flake | | 1 | | | | | S10,O5 | flake | | 1 | |
| 11d8 | retouch | 5 | 16 | 31.3 | S10,O7 | flake | | 1 | | | | | S10,O7 | flake | | 1 | |
| 5dsurf4 | core, p | 7 | 22 | 31.8 | S10e1 | flake | | | 1 | | | | S10e1 | flake | | 1 | |
| 5asurf5 | denticulate | 4 | 12 | 33.3 | S10e2 | flake | | | | 1 | | | S10e2 | flake | | 1 | |
| 8m4 | denticulate | 6 | 18 | 33.3 | 14c2 | flake | | 1 | | | | | 14c2 | flake | | 1 | |
| 10a3 | flake | 3 | 9 | 33.3 | 14c5 | flake | | 1 | | | | | 14c5 | flake | | 1 | |
| 14j1 | flake | 3 | 9 | 33.3 | s37e4 | flake | | | 1 | | | | s37e4 | flake | | | 1 |
| S10e1 | flake | 1 | 3 | 33.3 | s46e3 | flake | | 1 | | | | | s46e3 | flake | 1 | | |
| 14q1 | flake | 2 | 6 | 33.3 | S8,O1 | flake | | | 1 | | | | S8,O1 | flake | 1 | | |
| 21L3 | flake | 1 | 3 | 33.3 | 21g1 | flake | | 1 | | | | | 21g1 | flake | | 1 | |
| 8m3 | retouch | 6 | 18 | 33.3 | 21g2 | flake | | 1 | | | | | 21g2 | flake | 1 | | |
| s37e2 | retouch | 5 | 15 | 33.3 | 21g3 | flake | | 1 | | | | | 21g3 | flake | | 1 | |
| 5pdug6 | scraper | 8 | 24 | 33.3 | 11d2 | flake | | | | 1 | | | 11d2 | flake | | | 1 |
| 36a1 | denticulate | 7.0 | 20 | 35.0 | 11d5 | flake | | | | 1 | | | 11d5 | flake | | | 1 |
| 5asurf11 | retouch | 7 | 20 | 35.0 | 12a7 | flake | | | | | 1 | | 12a7 | flake | | | 1 |
| 5gsurf6 | chunk | 4 | 11 | 36.4 | 12a8 | flake | | | | | 1 | | 12a8 | flake | | | 1 |
| 14,O1 | denticulate | 4 | 11 | 36.4 | 14c3 | flake | | 1 | | | | | 14c3 | flake | | 1 | |
| 8n3 | scraper | 8 | 22 | 36.4 | 14h2 | flake | | 1 | | | | | 14h2 | flake | | | 1 |
| 14t1 | chunk | 3 | 8 | 37.5 | 14h3 | flake | | 1 | | | | | 14h3 | flake | | | 1 |
| 5asurf8 | chunk | 3 | 8 | 37.5 | 14h5 | flake | | 1 | | | | | 14h5 | flake | | | 1 |
| s37e1 | denticulate | 6 | 16 | 37.5 | 14n5 | flake | | | 1 | | | | 14n5 | flake | | | 1 |
| 46b3 | flake | 3 | 8 | 37.5 | 14q1 | flake | | 1 | | | | | 14q1 | flake | | 1 | |
| 34c | retouch | 3 | 8 | 37.5 | 14s1 | flake | | 1 | | | | | 14s1 | flake | | | 1 |
| 32d3 | scraper | 6 | 16 | 37.5 | 14t2 | flake | | | 1 | | | | 14t2 | flake | | | 1 |
| 6d3 | scraper | 6 | 16 | 37.5 | 14u1 | flake | | | 1 | | | | 14u1 | flake | | | 1 |
| 14d2 | scraper | 3 | 8 | 37.5 | 14u2 | flake | | | 1 | | | | 14u2 | flake | | | 1 |
| 14f5 | chopper core | 9 | 23 | 39.1 | 14v1 | flake | | | 1 | | | | 14v1 | flake | | 1 | |
| S10,O9 | scraper | 11 | 28 | 39.3 | 14w1 | flake | | | 1 | | | | 14w1 | flake | | | 1 |
| 10c7 | chunk | 2 | 5 | 40.0 | 14w2 | flake | | | 1 | | | | 14w2 | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14q3 | chunk | 2 | 5 | 40.0 | 20ak2 | flake | | | 1 | | | | 20ak2 | flake | | 1 | |
| 5idug1 | chunk | 2 | 5 | 40.0 | 20au1 | flake | | | 1 | | | | 20au1 | flake | | | 1 |
| S14e1 | chunk | 2 | 5 | 40.0 | 20t1 | flake | | | | 1 | | | 20t1 | flake | | 1 | |
| 8i5 | core, pi | 6 | 15 | 40.0 | 21b3 | flake | | | | 1 | | | 21b3 | flake | | | 1 |
| 20ak7 | denticulate | 8 | 20 | 40.0 | 21b6 | flake | | | | 1 | | | 21b6 | flake | | 1 | |
| 5esurf1 | flake | 2 | 5 | 40.0 | 21b8 | flake | | | | 1 | | | 21b8 | flake | | 1 | |
| 21c2 | flake | 2 | 5 | 40.0 | 21c1 | flake | | 1 | | | | | 21c1 | flake | | 1 | |
| 5dsurf1 | flake | 2 | 5 | 40.0 | 21c2 | flake | | 1 | | | | | 21c2 | flake | | 1 | |
| S8,O3 | flake | 2 | 5 | 40.0 | 21f4 | flake | | | 1 | | | | 21f4 | flake | | 1 | |
| 10u4 | retouch | 6 | 15 | 40.0 | 21L1 | flake | | 1 | | | | | 21L1 | flake | 1 | | |
| 10a1 | core, disc/prep | 9 | 22 | 40.9 | 21L2 | flake | | 1 | | | | | 21L2 | flake | 1 | | |
| 8n5 | core, p | 9 | 22 | 40.9 | 21L3 | flake | | 1 | | | | | 21L3 | flake | 1 | | |
| 5mdug4 | core, frag | 5 | 12 | 41.7 | 21L4 | flake | | 1 | | | | | 21L4 | flake | | 1 | |
| 5qdug4 | scraper | 10 | 24 | 41.7 | 21L5 | flake | | 1 | | | | | 21L5 | flake | 1 | | |
| 10f3 | scraper | 8 | 19 | 42.1 | 2a3 | flake | | | | 1 | | | 2a3 | flake | | | 1 |
| 46c3 | scraper | 8 | 19 | 42.1 | 32b1 | flake | | 1 | | | | | 32b1 | flake | 1 | | |
| 5bsurf6 | chunk | 3 | 7 | 42.9 | 32c3 | flake | | | | | | 1 | 32c3 | flake | | | 1 |
| 21b3 | flake | 3 | 7 | 42.9 | 32c5 | flake | | | | | | 1 | 32c5 | flake | | | 1 |
| 21g10 | core, pi | 14 | 32 | 43.8 | 32c7 | flake | | | | | | 1 | 32c7 | flake | | | 1 |
| 8v3 | scraper | 7 | 16 | 43.8 | 32c8 | flake | | | | | | 1 | 32c8 | flake | | | 1 |
| 14f1 | chunk | 4 | 9 | 44.4 | 33a1 | flake | | | 1 | | | | 33a1 | flake | | 1 | |
| 5asurf12 | chunk | 4 | 9 | 44.4 | 5asurf4 | flake | | | 1 | | | | 5asurf4 | flake | | 1 | |
| 8i6 | chunk | 4 | 9 | 44.4 | 5bsurf2 | flake | | 1 | | | | | 5bsurf2 | flake | 1 | | |
| 8i4 | scraper | 8 | 18 | 44.4 | 5bsurf3 | flake | | 1 | | | | | 5bsurf3 | flake | 1 | | |
| 5qdug6 | denticulate | 9 | 20 | 45.0 | 5dsurf1 | flake | | | | 1 | | | 5dsurf1 | flake | | | 1 |
| 5qdug9 | retouch | 9 | 20 | 45.0 | 5idug2 | flake | | 1 | | | | | 5idug2 | flake | | 1 | |
| 6d6 | chunk | 5 | 11 | 45.5 | 5idug6 | flake | | 1 | | | | | 5idug6 | flake | | 1 | |
| 10f2 | chunk | 3 | 6 | 50.0 | 5jsurf2 | flake | | | 1 | | | | 5jsurf2 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s37e3 | chunk | 2 | 4 | 50.0 | 5Odug1 | flake | | | 1 | | | | 5Odug1 | flake | | | 1 |
| 32d2 | core, flat | 3 | 6 | 50.0 | 5Odug2 | flake | | | 1 | | | | 5Odug2 | flake | | | 1 |
| 20au2 | core, frag | 6 | 12 | 50.0 | 5Odug3 | flake | | | 1 | | | | 5Odug3 | flake | | | 1 |
| 21b10 | core, p | 14 | 28 | 50.0 | 5Odug7 | flake | | | 1 | | | | 5Odug7 | flake | | | 1 |
| 14n10 | core, pi | 9 | 18 | 50.0 | 6d1 | flake | | | 1 | | | | 6d1 | flake | | 1 | |
| S10,O10 | core, pi | 12 | 24 | 50.0 | 8i2 | flake | | | 1 | | | | 8i2 | flake | | 1 | |
| 14c3 | flake | 1 | 2 | 50.0 | S10,O1 | flake | | 1 | | | | | S10,O1 | flake | | 1 | |
| 14n3 | flake | 1 | 2 | 50.0 | S8,O3 | flake | | | 1 | | | | S8,O3 | flake | | 1 | |
| 34c1 | flake | 1 | 2 | 50.0 | 21g6 | retouch | | 1 | | | | | 21g6 | retouch | 1 | | |
| S14e2 | flake | 1 | 2 | 50.0 | 10a5 | retouch | | 1 | | | | | 10a5 | retouch | 1 | | |
| 14u2 | flake | 1 | 2 | 50.0 | 10c2 | retouch | | | | 1 | | | 10c2 | retouch | 1 | | |
| 20au1 | flake | 2 | 4 | 50.0 | 10c3 | retouch | | | | 1 | | | 10c3 | retouch | 1 | | |
| S10,O1 | flake | 2 | 4 | 50.0 | 10u4 | retouch | | | 1 | | | | 10u4 | retouch | | 1 | |
| S10,O4 | retouch | 7 | 14 | 50.0 | 11d12 | retouch | | | | 1 | | | 11d12 | retouch | | | 1 |
| 32c9 | scraper | 5 | 10 | 50.0 | 11d8 | retouch | | | | 1 | | | 11d8 | retouch | | | 1 |
| 6a3 | core, p | 17 | 33 | 51.5 | 14f2 | retouch | | 1 | | | | | 14f2 | retouch | | 1 | |
| 10f5 | core, flat/p | 12 | 23 | 52.2 | 14f7 | retouch | | 1 | | | | | 14f7 | retouch | | 1 | |
| 5fsurf2 | core, p | 12 | 23 | 52.2 | 14h7 | retouch | | 1 | | | | | 14h7 | retouch | | | 1 |
| 7a3 | core, pi | 8 | 15 | 53.3 | 14h8 | retouch | | 1 | | | | | 14h8 | retouch | | | 1 |
| 10d1 | denticulate | 15 | 28 | 53.6 | 14j2 | retouch | | | 1 | | | | 14j2 | retouch | | | 1 |
| 5esurf3 | core, p | 7 | 13 | 53.8 | 14n6 | retouch | | | 1 | | | | 14n6 | retouch | | | 1 |
| S10,O11 | scraper | 7 | 13 | 53.8 | 14n7 | retouch | | | 1 | | | | 14n7 | retouch | | | 1 |
| 5fsurf1 | scraper | 12 | 22 | 54.5 | 14q2 | retouch | | 1 | | | | | 14q2 | retouch | | 1 | |
| 5idug5 | scraper | 6 | 11 | 54.5 | 14v3 | retouch | | | 1 | | | | 14v3 | retouch | | 1 | |
| 31a3 | core, flat/prep | 11 | 20 | 55.0 | 20ak6 | retouch | | | 1 | | | | 20ak6 | retouch | | 1 | |
| 46a3 | chunk | 5 | 9 | 55.6 | 20t4 | retouch | | | | 1 | | | 20t4 | retouch | | 1 | |
| S10,O2 | chunk | 5 | 9 | 55.6 | 21b7 | retouch | | | | 1 | | | 21b7 | retouch | | 1 | |
| 20ak5 | core, cent | 15 | 27 | 55.6 | 21c6 | retouch | | 1 | | | | | 21c6 | retouch | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46b2 | core, flat | 10 | 18 | 55.6 | 21h4 | retouch | | 1 | | | | | 21h4 | retouch | | 1 | |
| 36a3 | chunk | 4 | 7 | 57.1 | 21L6 | retouch | | 1 | | | | | 21L6 | retouch | 1 | | |
| 5ddug3 | chunk | 4 | 7 | 57.1 | 2a8 | retouch | | | | 1 | | | 2a8 | retouch | | | 1 |
| 5pdug8 | core, cent | 12 | 21 | 57.1 | 31a4 | retouch | | 1 | | | | | 31a4 | retouch | | 1 | |
| 5bsurf3 | flake | 4 | 7 | 57.1 | 32b4 | retouch | | 1 | | | | | 32b4 | retouch | 1 | | |
| 5asurf13 | core, p | 15 | 26 | 57.7 | 32b8 | retouch | | 1 | | | | | 32b8 | retouch | 1 | | |
| 10c1 | scraper | 11 | 19 | 57.9 | 32d1 | retouch | | 1 | | | | | 32d1 | retouch | | | 1 |
| 14j3 | cleaver / chopper | 10 | 17 | 58.8 | 32d4 | retouch | | 1 | | | | | 32d4 | retouch | | | 1 |
| 14p1 | chunk | 3 | 5 | 60.0 | 33a2 | retouch | | | 1 | | | | 33a2 | retouch | | 1 | |
| 14s3 | chunk | 3 | 5 | 60.0 | 34c | retouch | | 1 | | | | | 34c | retouch | | 1 | |
| 20ak1 | chunk | 3 | 5 | 60.0 | 34c4 | retouch | | 1 | | | | | 34c4 | retouch | | 1 | |
| 5pdug4 | core, cent | 9 | 15 | 60.0 | 36c3 | retouch | | | 1 | | | | 36c3 | retouch | 1 | | |
| 31a4 | flake | 3 | 5 | 60.0 | 36d1 | retouch | | | 1 | | | | 36d1 | retouch | | | 1 |
| 20ak2 | flake | 6 | 10 | 60.0 | 37a3 | retouch | | | 1 | | | | 37a3 | retouch | | 1 | |
| 32c8 | flake | 3 | 5 | 60.0 | 37a4 | retouch | | | 1 | | | | 37a4 | retouch | 1 | | |
| 8m2 | scraper | 16 | 26 | 61.5 | 46a4 | retouch | | 1 | | | | | 46a4 | retouch | | 1 | |
| 8L8 | chunk | 5 | 8 | 62.5 | 46b5 | retouch | | | 1 | | | | 46b5 | retouch | | 1 | |
| 6d4 | core, cent | 15 | 24 | 62.5 | 46d2 | retouch | | 1 | | | | | 46d2 | retouch | | 1 | |
| 14d1 | flake | 5 | 8 | 62.5 | 5asurf11 | retouch | | | 1 | | | | 5asurf11 | retouch | | 1 | |
| 46a1 | core, cent | 11 | 17 | 64.7 | 5asurf6 | retouch | | | 1 | | | | 5asurf6 | retouch | 1 | | |
| 37a7 | core, pi | 13 | 20 | 65.0 | 5bsurf14 | retouch | | 1 | | | | | 5bsurf14 | retouch | 1 | | |
| 10u1 | chunk | 2 | 3 | 66.7 | 5bsurf7 | retouch | | 1 | | | | | 5bsurf7 | retouch | 1 | | |
| 20t2 | chunk | 6 | 9 | 66.7 | 5dsurf2 | retouch | | | | 1 | | | 5dsurf2 | retouch | | | 1 |
| 21L11 | chunk | 4 | 6 | 66.7 | 5fsurf5 | retouch | | 1 | | | | | 5fsurf5 | retouch | | 1 | |
| 37a5 | chunk | 2 | 3 | 66.7 | 5idug8 | retouch | | 1 | | | | | 5idug8 | retouch | | 1 | |
| 7a1 | chunk | 2 | 3 | 66.7 | 5idug9 | retouch | | 1 | | | | | 5idug9 | retouch | | 1 | |
| 21h5 | core, flat | 10 | 15 | 66.7 | 5Ldug1 | retouch | | | 1 | | | | 5Ldug1 | retouch | | | 1 |
| 37a6 | flake | 4 | 6 | 66.7 | 5pdug1 | retouch | | 1 | | | | | 5pdug1 | retouch | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5idug2 | flake | 6 | 9 | 66.7 | 5pdug7 | retouch | | 1 | | | | | 5pdug7 | retouch | | | 1 |
| 5jsurf2 | flake | 2 | 3 | 66.7 | 5qdug8 | retouch | | | 1 | | | | 5qdug8 | retouch | | 1 | |
| 6d1 | flake | 2 | 3 | 66.7 | 5qdug9 | retouch | | | 1 | | | | 5qdug9 | retouch | | 1 | |
| 21b4 | scraper | 2 | 3 | 66.7 | 6a3 | retouch | | 1 | | | | | 6a3 | retouch | | 1 | |
| S14e6 | scraper | 6 | 9 | 66.7 | 6d7 | retouch | | | 1 | | | | 6d7 | retouch | | 1 | |
| 8n7 | chunk | 5 | 7 | 71.4 | 7a4 | retouch | | 1 | | | | | 7a4 | retouch | | | 1 |
| 21g7 | flake | 5 | 7 | 71.4 | 8L11 | retouch | | | 1 | | | | 8L11 | retouch | | 1 | |
| 5Odug6 | core, cent | 8 | 11 | 72.7 | 8L7 | retouch | | | 1 | | | | 8L7 | retouch | | 1 | |
| 5jsurf3 | denticulate | 8 | 11 | 72.7 | 8m3 | retouch | | | 1 | | | | 8m3 | retouch | | 1 | |
| 8v5 | retouch | 14 | 19 | 73.7 | 8n1 | retouch | | | | 1 | | | 8n1 | retouch | | 1 | |
| 32c4 | chunk | 3 | 4 | 75.0 | 8v5 | retouch | | 1 | | | | | 8v5 | retouch | | 1 | |
| 5mdug1 | chunk | 3 | 4 | 75.0 | S10,O4 | retouch | | 1 | | | | | S10,O4 | retouch | | 1 | |
| S14e7 | chunk | 3 | 4 | 75.0 | S10,O8 | retouch | | 1 | | | | | S10,O8 | retouch | | 1 | |
| 5idug7 | flake | 3 | 4 | 75.0 | S14e11 | retouch | | 1 | | | | | S14e11 | retouch | | 1 | |
| 8m5 | flake | 3 | 4 | 75.0 | 14c4 | retouch | | 1 | | | | | 14c4 | retouch | | 1 | |
| 20t1 | flake | 3 | 4 | 75.0 | s37e2 | retouch | | | 1 | | | | s37e2 | retouch | | | 1 |
| 5esurf5 | scraper | 15 | 20 | 75.0 | s46e5 | retouch | | 1 | | | | | s46e5 | retouch | | 1 | |
| 14u5 | chunk | 10 | 13 | 76.9 | 21c3 | retouch | | 1 | | | | | 21c3 | retouch | | 1 | |
| 21b5 | flake | 7 | 9 | 77.8 | 14p3 | scraper | | | | 1 | | | 14p3 | scraper | | | 1 |
| 21g9 | chunk | 4 | 5 | 80.0 | 21g5 | scraper | | 1 | | | | | 21g5 | scraper | | 1 | |
| 14d3 | flake | 4 | 5 | 80.0 | 10a2 | scraper | | | 1 | | | | 10a2 | scraper | 1 | | |
| 20ak3 | flake | 4 | 5 | 80.0 | 10c1 | scraper | | | | 1 | | | 10c1 | scraper | | 1 | |
| 5esurf2 | flake | 4 | 5 | 80.0 | 10f3 | scraper | | 1 | | | | | 10f3 | scraper | | 1 | |
| 5fsurf4 | flake | 4 | 5 | 80.0 | 10f6 | scraper | | 1 | | | | | 10f6 | scraper | | 1 | |
| 21g2 | flake | 4 | 5 | 80.0 | 10u2 | scraper | | | 1 | | | | 10u2 | scraper | | 1 | |
| 32b1 | flake | 4 | 5 | 80.0 | 11d11 | scraper | | | | 1 | | | 11d11 | scraper | | | 1 |
| 5idug6 | flake | 4 | 5 | 80.0 | 11d7 | scraper | | | | 1 | | | 11d7 | scraper | | | 1 |
| S14e10 | core chunk | 13 | 16 | 81.3 | 12a6 | scraper | | | | | 1 | | 12a6 | scraper | | | 1 |
| 8v4 | core, p | 20 | 24 | 83.3 | 14f4 | scraper | | 1 | | | | | 14f4 | scraper | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S10,O5 | flake | 5 | 6 | 83.3 | 14n11 | scraper | | | 1 | | | | 14n11 | scraper | | | 1 |
| 5Odug12 | scraper | 10 | 12 | 83.3 | 14n9 | scraper | | | 1 | | | | 14n9 | scraper | | | 1 |
| s37e5 | core, flat | 12 | 14 | 85.7 | 14t5 | scraper | | | 1 | | | | 14t5 | scraper | | | 1 |
| 14,O3 | core, pi | 6 | 7 | 85.7 | 20aj1 | scraper | | 1 | | | | | 20aj1 | scraper | | 1 | |
| 10d4 | flake | 6 | 7 | 85.7 | 20ak4 | scraper | | | 1 | | | | 20ak4 | scraper | | 1 | |
| 8v1 | flake | 6 | 7 | 85.7 | 20t3 | scraper | | | | 1 | | | 20t3 | scraper | | 1 | |
| S14e5 | flake | 6 | 7 | 85.7 | 21b4 | scraper | | | | 1 | | | 21b4 | scraper | | 1 | |
| 14t5 | scraper | 12 | 14 | 85.7 | 21c5 | scraper | | 1 | | | | | 21c5 | scraper | | 1 | |
| 46a2 | flake | 7 | 8 | 87.5 | 21f3 | scraper | | | 1 | | | | 21f3 | scraper | | 1 | |
| 5Odug9 | flake | 9 | 10 | 90.0 | 21L8 | scraper | | 1 | | | | | 21L8 | scraper | 1 | | |
| 21b6 | flake | 9 | 10 | 90.0 | 32b6 | scraper | | 1 | | | | | 32b6 | scraper | 1 | | |
| 5Odug8 | core, p | 15 | 16 | 93.8 | 32b9 | scraper | | 1 | | | | | 32b9 | scraper | 1 | | |
| 14p2 | chunk | 1 | 1 | 100.0 | 32c9 | scraper | | | | | | 1 | 32c9 | scraper | | | 1 |
| 14,O2 | chunk | 4 | 4 | 100.0 | 32d3 | scraper | | 1 | | | | | 32d3 | scraper | | | 1 |
| 14c2 | chunk | 4 | 4 | 100.0 | 36a4 | scraper | | | 1 | | | | 36a4 | scraper | 1 | | |
| 14d7 | chunk | 5 | 5 | 100.0 | 37a2 | scraper | | | 1 | | | | 37a2 | scraper | | 1 | |
| 14u3 | chunk | 4 | 4 | 100.0 | 37d1 | scraper | | | | | 1 | | 37d1 | scraper | | | 1 |
| 20aj4 | chunk | 3 | 3 | 100.0 | 46a5 | scraper | | 1 | | | | | 46a5 | scraper | | 1 | |
| 21c7 | chunk | 3 | 3 | 100.0 | 46b6 | scraper | | | 1 | | | | 46b6 | scraper | | 1 | |
| 31a2 | chunk | 5 | 5 | 100.0 | 46c3 | scraper | | 1 | | | | | 46c3 | scraper | | | 1 |
| 32b12 | chunk | 3 | 3 | 100.0 | 5asurf1 | scraper | | | 1 | | | | 5asurf1 | scraper | 1 | | |
| 34c3 | chunk | 1 | 1 | 100.0 | 5asurf7 | scraper | | | 1 | | | | 5asurf7 | scraper | | 1 | |
| 37d2 | chunk | 4 | 4 | 100.0 | 5bsurf12 | scraper | | 1 | | | | | 5bsurf12 | scraper | 1 | | |
| 46d1 | chunk | 5 | 5 | 100.0 | 5bsurf4 | scraper | | 1 | | | | | 5bsurf4 | scraper | 1 | | |
| 5bsurf13 | chunk | 4 | 4 | 100.0 | 5esurf5 | scraper | | | | 1 | | | 5esurf5 | scraper | | | 1 |
| 5ddug2 | chunk | 3 | 3 | 100.0 | 5fsurf1 | scraper | | 1 | | | | | 5fsurf1 | scraper | | 1 | |
| 5Odug4 | chunk | 7 | 7 | 100.0 | 5gsurf1 | scraper | | 1 | | | | | 5gsurf1 | scraper | 1 | | |
| 5Odug5 | chunk | 4 | 4 | 100.0 | 5idug12 | scraper | | 1 | | | | | 5idug12 | scraper | | 1 | |
| 5qdug7 | chunk | 4 | 4 | 100.0 | 5idug5 | scraper | | 1 | | | | | 5idug5 | scraper | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6a4 | chunk | 2 | 2 | 100.0 | 5jsurf1 | scraper | | | 1 | | | | 5jsurf1 | scraper | | 1 | |
| 8m6 | chunk | 3 | 3 | 100.0 | 5Ldug4 | scraper | | 1 | | | | | 5Ldug4 | scraper | | | 1 |
| 8v2 | chunk | 2 | 2 | 100.0 | 5mdug3 | scraper | | | 1 | | | | 5mdug3 | scraper | | 1 | |
| S10,O12 | chunk | 2 | 2 | 100.0 | 5Odug11 | scraper | | | 1 | | | | 5Odug11 | scraper | | | 1 |
| S14e9 | core chunk | 8 | 8 | 100.0 | 5Odug12 | scraper | | | 1 | | | | 5Odug12 | scraper | | | 1 |
| 37d4 | core, cent | 19 | 19 | 100.0 | 5pdug2 | scraper | | | 1 | | | | 5pdug2 | scraper | | | 1 |
| 14t3 | core, cent / chopper | 9 | 9 | 100.0 | 5pdug6 | scraper | | 1 | | | | | 5pdug6 | scraper | | | 1 |
| 5ddug4 | core, frag | 4 | 4 | 100.0 | 5qdug1 | scraper | | | 1 | | | | 5qdug1 | scraper | | 1 | |
| 5ddug5 | core, pi | 8 | 8 | 100.0 | 5qdug2 | scraper | | | 1 | | | | 5qdug2 | scraper | | 1 | |
| 10f1 | flake | 4 | 4 | 100.0 | 5r1 | scraper | | 1 | | | | | 5r1 | scraper | | | 1 |
| 14u4 | flake | 2 | 2 | 100.0 | 6d3 | scraper | | | 1 | | | | 6d3 | scraper | | 1 | |
| 14v4 | flake | 1 | 1 | 100.0 | 7a2 | scraper | | 1 | | | | | 7a2 | scraper | | 1 | |
| 37d3 | flake | 1 | 1 | 100.0 | 8i4 | scraper | | | 1 | | | | 8i4 | scraper | | 1 | |
| 5Odug10 | flake | 1 | 1 | 100.0 | 8L3 | scraper | | | 1 | | | | 8L3 | scraper | | 1 | |
| 6d2 | flake | 3 | 3 | 100.0 | 8L5 | scraper | | | 1 | | | | 8L5 | scraper | | 1 | |
| S10,O7 | flake | 2 | 2 | 100.0 | 8m2 | scraper | | | 1 | | | | 8m2 | scraper | | 1 | |
| s37e4 | flake | 3 | 3 | 100.0 | 8n3 | scraper | | | 1 | | | | 8n3 | scraper | | 1 | |
| 21g3 | flake | 2 | 2 | 100.0 | 8v3 | scraper | | 1 | | | | | 8v3 | scraper | | 1 | |
| 14c3 | flake | 6 | 6 | 100.0 | S10,O11 | scraper | | 1 | | | | | S10,O11 | scraper | | 1 | |
| 14t2 | flake | 1 | 1 | 100.0 | S10,O9 | scraper | | 1 | | | | | S10,O9 | scraper | | 1 | |
| 21b8 | flake | 1 | 1 | 100.0 | 14c6 | scraper | | 1 | | | | | 14c6 | scraper | | 1 | |
| 21f4 | flake | 1 | 1 | 100.0 | 14c8 | scraper | | 1 | | | | | 14c8 | scraper | | 1 | |
| 5Odug1 | flake | 6 | 6 | 100.0 | s36e2 | scraper | | | 1 | | | | s36e2 | scraper | | | 1 |
| 5Odug2 | flake | 2 | 2 | 100.0 | s46e6 | scraper | | 1 | | | | | s46e6 | scraper | 1 | | |
| 5Odug3 | flake | 4 | 4 | 100.0 | S8,O2 | scraper | | | 1 | | | | S8,O2 | scraper | 1 | | |
| 5Odug7 | flake | 3 | 3 | 100.0 | 14d2 | scraper | | 1 | | | | | 14d2 | scraper | | 1 | |
| 8i2 | flake | 1 | 1 | 100.0 | 21f1 | scraper | | | 1 | | | | 21f1 | scraper | | | 1 |
| 37d1 | scraper | 21 | 21 | 100.0 | 21h3 | scraper | | 1 | | | | | 21h3 | scraper | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5Odug11 | scraper | 16 | 16 | 100.0 | 31a1 | scraper | | 1 | | | | | 31a1 | scraper | | 1 | |
| S14e8 | scraper | 12 | 12 | 100.0 | 5qdug4 | scraper | | | 1 | | | | 5qdug4 | scraper | | 1 | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | | **n** | | | | |
| **445** | | | | 36.4% | **445** | | 0 | 200 | 167 | 57 | 11 | 10 | **445** | | 62 | 233 | 150 |
| | | | | | | Percentage of sample | 0.0 | 44.9 | 37.5 | 12.8 | 2.5 | 2.2 | | Percentage of sample | 13.9 | 52.4 | 33.7 |

**Table 14: Experimental Oldowan quartz raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| **Sn** | **Tt** | **Iscar** | **Dscar** | **% F** | **Sn** | **Tt** | **f** | **L, mm** | **w, mm** | **a cm2** | **f/cm2** | **f/10 cm2** | **Sn** | **Tt** | **N** | **S** | **E** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10q3 | chunk | 6 | 6 | 100.0 | 10q3 | chunk | 15 | 18.3 | 11.3 | 2.1 | 7.3 | 72.5 | 10q3 | chunk | | | 1 |
| 10w11 | chunk | 3 | 3 | 100.0 | 10w11 | chunk | 16 | 17.1 | 12.4 | 2.1 | 7.5 | 75.5 | 10w11 | chunk | | 1 | |
| 10w5 | chunk | 4 | 4 | 100.0 | 10w5 | chunk | 9 | 18.6 | 10.5 | 2.0 | 4.6 | 46.1 | 10w5 | chunk | | 1 | |
| 13b6 | chunk | 0 | 4 | 0.0 | 13b6 | chunk | 5 | 15.3 | 10.3 | 1.6 | 3.2 | 31.7 | 13b6 | chunk | 1 | | |
| 14a4 | chunk | 4 | 5 | 80.0 | 14a4 | chunk | 5 | 18.6 | 16.5 | 3.1 | 1.6 | 16.3 | 14a4 | chunk | | 1 | |
| 15f4 | chunk | 8 | 8 | 100.0 | 15f4 | chunk | 18 | 28 | 23.8 | 6.7 | 2.7 | 27.0 | 15f4 | chunk | | | 1 |
| 15L1 | chunk | 1 | 3 | 33.3 | 15L1 | chunk | 3 | 15 | 11.6 | 1.7 | 1.7 | 17.2 | 15L1 | chunk | 1 | | |
| 15L12 | chunk | 1 | 5 | 20.0 | 15L12 | chunk | 3 | 16.9 | 11.8 | 2.0 | 1.5 | 15.0 | 15L12 | chunk | 1 | | |
| 15p1 | chunk | 1 | 3 | 33.3 | 15p1 | chunk | 1 | 18 | 8.3 | 1.5 | 0.7 | 6.7 | 15p1 | chunk | 1 | | |
| 15s2 | chunk | 3 | 6 | 50.0 | 15s2 | chunk | 3 | 18 | 16.5 | 3.0 | 1.0 | 10.1 | 15s2 | chunk | | 1 | |
| 15s3 | chunk | 2 | 2 | 100.0 | 15s3 | chunk | 3 | 24 | 10.4 | 2.5 | 1.2 | 12.0 | 15s3 | chunk | | 1 | |
| 1k3 | chunk | 3 | 5 | 60.0 | 1k3 | chunk | 8 | 13.3 | 11.2 | 1.5 | 5.4 | 53.7 | 1k3 | chunk | | 1 | |
| 20aq6 | chunk | 4 | 4 | 100.0 | 20aq6 | chunk | 20 | 24.6 | 15.5 | 3.8 | 5.2 | 52.5 | 20aq6 | chunk | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21i5 | chunk | 3 | 4 | 75.0 | 21i5 | chunk | 12 | 18.7 | 12 | 2.2 | 5.3 | 53.5 | 21i5 | chunk | | | 1 |
| 21q5 | chunk | 0 | 5 | 0.0 | 21q5 | chunk | 1 | 32.7 | 14.3 | 4.7 | 0.2 | 2.1 | 21q5 | chunk | 1 | | |
| 23g1 | chunk | 1 | 2 | 50.0 | 23g1 | chunk | 0 | 25.3 | 13.0 | 3.3 | 0.0 | 0.0 | 23g1 | chunk | | 1 | |
| 27c11 | chunk | 5 | 5 | 100.0 | 27c11 | chunk | 5 | 13.0 | 12.0 | 1.6 | 3.2 | 32.1 | 27c11 | chunk | | 1 | |
| 32f2 | chunk | 4 | 5 | 80.0 | 32f2 | chunk | 5 | 33.2 | 17.6 | 5.8 | 0.9 | 8.6 | 32f2 | chunk | | | 1 |
| 32f6 | chunk | 3 | 3 | 100.0 | 32f6 | chunk | 4 | 18.7 | 13.6 | 2.5 | 1.6 | 15.7 | 32f6 | chunk | | | 1 |
| 32g1 | chunk | 2 | 2 | 100.0 | 32g1 | chunk | 2 | 38 | 10.6 | 4.0 | 0.5 | 5.0 | 32g1 | chunk | | 1 | |
| 32g4 | chunk | 1 | 2 | 50.0 | 32g4 | chunk | 2 | 23.8 | 7.8 | 1.9 | 1.1 | 10.8 | 32g4 | chunk | | 1 | |
| 35a4 | chunk | 3 | 5 | 60.0 | 35a4 | chunk | 14 | 19.8 | 18.4 | 3.6 | 3.8 | 38.4 | 35a4 | chunk | | 1 | |
| 35b3 | chunk | 2 | 3 | 66.7 | 35b3 | chunk | 1 | 19.7 | 18.4 | 3.6 | 0.3 | 2.8 | 35b3 | chunk | 1 | | |
| 36b3 | chunk | 3 | 3 | 100.0 | 36b3 | chunk | 6 | 27.7 | 19.6 | 5.4 | 1.1 | 11.1 | 36b3 | chunk | 1 | | |
| 36f3 | chunk | 0 | 7 | 0.0 | 36f3 | chunk | 9 | 16.8 | 14.2 | 2.4 | 3.8 | 37.7 | 36f3 | chunk | 1 | | |
| 37f2 | chunk | 4 | 7 | 57.1 | 37f2 | chunk | 10 | 27.4 | 16.5 | 4.5 | 2.2 | 22.1 | 37f2 | chunk | | 1 | |
| 40b2 | chunk | 4 | 4 | 100.0 | 40b2 | chunk | 12 | 30.4 | 16.6 | 5.0 | 2.4 | 23.8 | 40b2 | chunk | | | 1 |
| 43a6 | chunk | 3 | 6 | 50.0 | 43a6 | chunk | 5 | 18.5 | 15.6 | 2.9 | 1.7 | 17.3 | 43a6 | chunk | | 1 | |
| 46f3 | chunk | 2 | 3 | 66.7 | 46f3 | chunk | 8 | 15.7 | 8.8 | 1.4 | 5.8 | 57.9 | 46f3 | chunk | | | 1 |
| 46h2 | chunk | 4 | 4 | 100.0 | 46h2 | chunk | 17 | 13.0 | 9.0 | 1.2 | 14.5 | 145.3 | 46h2 | chunk | | | 1 |
| 46i4 | chunk | 1 | 4 | 25.0 | 46i3 | chunk | 11 | 18.0 | 12.6 | 2.3 | 4.9 | 48.5 | 46i3 | chunk | 1 | | |
| 46j3 | chunk | 3 | 3 | 100.0 | 46j3 | chunk | 7 | 9.6 | 8.5 | 0.8 | 8.6 | 85.8 | 46j3 | chunk | | 1 | |
| 50f | chunk | 5 | 6 | 83.3 | 50f | chunk | 14 | 21.5 | 20.3 | 4.4 | 3.2 | 32.1 | 50f | chunk | | | 1 |
| 50g | chunk | 4 | 8 | 50.0 | 50g | chunk | 7 | 23.0 | 12.8 | 2.9 | 2.4 | 23.8 | 50g | chunk | | 1 | |
| 50j | chunk | 1 | 4 | 25.0 | 50j | chunk | 1 | 23.0 | 16.4 | 3.8 | 0.3 | 2.7 | 50j | chunk | | 1 | |
| 54a,c2 | chunk | 6 | 7 | 85.7 | 54a,c2 | chunk | 15 | 29.7 | 24.6 | 7.3 | 2.1 | 20.5 | 54a,c2 | chunk | | 1 | |
| 56b2 | chunk | 3 | 3 | 100.0 | 56b2 | chunk | 7 | 19.0 | 12.5 | 2.4 | 2.9 | 29.5 | 56b2 | chunk | | | 1 |
| 56c2 | chunk | 1 | 2 | 50.0 | 56c2 | chunk | 5 | 18.6 | 11.1 | 2.1 | 2.4 | 24.2 | 56c2 | chunk | 1 | | |
| 5nsurf5 | chunk | 7 | 18 | 38.9 | 5nsurf5 | chunk | 18 | 18.1 | 9.7 | 1.8 | 10.3 | 102.5 | 5nsurf5 | chunk | | | 1 |
| 5Osurf3 | chunk | 5 | 7 | 71.4 | 5Osurf3 | chunk | 12 | 34.6 | 17.7 | 6.1 | 2.0 | 19.6 | 5Osurf3 | chunk | | | 1 |
| 5rsurf1 | chunk | 0 | 4 | 0.0 | 5rsurf1 | chunk | 7 | 17.6 | 14.2 | 2.5 | 2.8 | 28.0 | 5rsurf1 | chunk | 1 | | |
| 5stsurf4 | chunk | 3 | 5 | 60.0 | 5stsurf4 | chunk | 3 | 15.8 | 12.8 | 2.0 | 1.5 | 14.8 | 5stsurf4 | chunk | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5usurf6 | chunk | 5 | 5 | 100.0 | 5usurf6 | chunk | 3 | 19 | 15.9 | 3.0 | 1.0 | 9.9 | 5usurf6 | chunk | | 1 | |
| 8a4 | chunk | 0 | 6 | 0.0 | 8a4 | chunk | 3 | 20.2 | 8.5 | 1.7 | 1.7 | 17.5 | 8a4 | chunk | 1 | | |
| 8b2 | chunk | 5 | 6 | 83.3 | 8b2 | chunk | 19 | 15.3 | 15.3 | 2.3 | 8.1 | 81.2 | 8b2 | chunk | | | 1 |
| 8c6 | chunk | 4 | 6 | 66.7 | 8c6 | chunk | 7 | 24.6 | 19.9 | 4.9 | 1.4 | 14.3 | 8c6 | chunk | | 1 | |
| 8d4 | chunk | 2 | 2 | 100.0 | 8d4 | chunk | 8 | 15.9 | 14 | 2.2 | 3.6 | 35.9 | 8d4 | chunk | | | 1 |
| 8g6 | chunk | 0 | 7 | 0.0 | 8g6 | chunk | 3 | 19.4 | 14.5 | 2.8 | 1.1 | 10.7 | 8g6 | chunk | 1 | | |
| S15e1 | chunk | 4 | 5 | 80.0 | S15e1 | chunk | 2 | 27.5 | 19 | 5.2 | 0.4 | 3.8 | S15e1 | chunk | | 1 | |
| s38e3 | chunk | 2 | 2 | 100.0 | s38e3 | chunk | 2 | 17.7 | 15.3 | 2.7 | 0.7 | 7.4 | s38e3 | chunk | 1 | | |
| S6e11 | chunk | 4 | 6 | 66.7 | S6e11 | chunk | 5 | 25.5 | 21.7 | 5.5 | 0.9 | 9.0 | S6e11 | chunk | | 1 | |
| S6e2 | chunk | 9 | 11 | 81.8 | S6e2 | chunk | 9 | 39.8 | 25.6 | 10.2 | 0.9 | 8.8 | S6e2 | chunk | | 1 | |
| 10p1 | chunk | 2 | 8 | 25.0 | 10p1 | chunk | 21 | 46.7 | 24.2 | 11.3 | 1.9 | 18.6 | 10p1 | chunk | | 1 | |
| 5hsurf3 | chunk | 7 | 10 | 70.0 | 5hsurf3 | chunk | 3 | 33.7 | 19.2 | 6.5 | 0.5 | 4.6 | 5hsurf3 | chunk | | 1 | |
| 14g3 | chunk | 4 | 10 | 40.0 | 14g3 | chunk | 10 | 24.7 | 24.7 | 6.1 | 1.6 | 16.4 | 14g3 | chunk | 1 | | |
| 6k3 | chunk | 4 | 4 | 100.0 | 6k3 | chunk | 3 | 23.6 | 19.3 | 4.6 | 0.7 | 6.6 | 6k3 | chunk | | 1 | |
| 10aa2 | core, bip | 6 | 16 | 37.5 | 10aa2 | core, bip | 11 | 15 | 15 | 2.3 | 4.9 | 48.9 | 10aa2 | core, bip | | 1 | |
| 10ac2 | core, bip | 1 | 6 | 16.7 | 10ac2 | core, bip | 3 | 30 | 24 | 7.2 | 0.4 | 4.2 | 10ac2 | core, bip | 1 | | |
| 5v3 | core, bip | 5 | 12 | 41.7 | 5v3 | core, bip | 4 | 32.5 | 17.5 | 5.7 | 0.7 | 7.0 | 5v3 | core, bip | 1 | | |
| 15f1 | core, c | 8 | 16 | 50.0 | 15f1 | core, c | 3 | 19.6 | 10.4 | 2.0 | 1.5 | 14.7 | 15f1 | core, c | | 1 | |
| 10w10 | core, casual | 4 | 7 | 57.1 | 10w10 | core, casual | 6 | 8.5 | 7.8 | 0.7 | 9.0 | 90.5 | 10w10 | core, casual | | 1 | |
| 35b1 | core, cent | 4 | 21 | 19.0 | 35b1 | core, cent | 5 | 33.1 | 32.6 | 10.8 | 0.5 | 4.6 | 35b1 | core, cent | 1 | | |
| 40b1 | core, cent | 8 | 8 | 100.0 | 40b1 | core, cent | 13 | 29.0 | 19.2 | 5.6 | 2.3 | 23.3 | 40b1 | core, cent | | | 1 |
| 43a1 | core, cent | 10 | 21 | 47.6 | 43a1 | core, cent | 6 | 27.8 | 25.7 | 7.1 | 0.8 | 8.4 | 43a1 | core, cent | 1 | | |
| 46j6 | core, cent | 8 | 17 | 47.1 | 46j6 | core, cent | 8 | 6.5 | 7.8 | 0.5 | 15.8 | 157.8 | 46j6 | core, cent | | 1 | |
| 53b | core, cent | 8 | 15 | 53.3 | 53b | core, cent | 6 | 28.4 | 18.0 | 5.1 | 1.2 | 11.7 | 53b | core, cent | | 1 | |
| 54a,c5 | core, cent | 13 | 20 | 65.0 | 54a,c5 | core, cent | 13 | 16.0 | 13.1 | 2.1 | 6.2 | 62.0 | 54a,c5 | core, cent | 1 | | |
| 56b5 | core, cent | 16 | 19 | 84.2 | 56b5 | core, cent | 13 | 20.8 | 12.0 | 2.5 | 5.2 | 52.1 | 56b5 | core, cent | | | 1 |
| 56c5 | core, cent | 8 | 23 | 34.8 | 56c5 | core, cent | 8 | 17.2 | 15.7 | 2.7 | 3.0 | 29.6 | 56c5 | core, cent | | 1 | |
| 5nsurf3 | core, cent | 10 | 20 | 50.0 | 5nsurf3 | core, cent | 18 | 22.2 | 17.8 | 4.0 | 4.6 | 45.6 | 5nsurf3 | core, cent | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8g5 | core, cent | 5 | 21 | 23.8 | 8g5 | core, cent | 11 | 16.7 | 13.8 | 2.3 | 4.8 | 47.7 | 8g5 | core, cent | | 1 | |
| s38e1 | core, cent | 7 | 14 | 50.0 | s38e1 | core, cent | 4 | 18.4 | 23.0 | 4.2 | 0.9 | 9.5 | s38e1 | core, cent | 1 | | |
| 6L2 | core, cent | 2 | 15 | 13.3 | 6L2 | core, cent | 3 | 26.9 | 26.6 | 7.2 | 0.4 | 4.2 | 6L2 | core, cent | | 1 | |
| 6k2 | core, cent | 16 | 25 | 64.0 | 6k2 | core, cent | 4 | 24 | 20.4 | 4.9 | 0.8 | 8.2 | 6k2 | core, cent | | 1 | |
| 8f3 | core, cent | 10 | 14 | 71.4 | 8f3 | core, cent | 6 | 21.6 | 20 | 4.3 | 1.4 | 13.9 | 8f3 | core, cent | | 1 | |
| 10w9 | core, flat | 6 | 13 | 46.2 | 10w9 | core, flat | 12 | 16.7 | 9.1 | 1.5 | 7.9 | 79.0 | 10w9 | core, flat | | 1 | |
| 21i8 | core, flat | 8 | 14 | 57.1 | 21i8 | core, flat | 15 | 27.5 | 23.7 | 6.5 | 2.3 | 23.0 | 21i8 | core, flat | | 1 | |
| 6j3 | core, flat | 5 | 19 | 26.3 | 6j3 | core, flat | 14 | 38.7 | 36.5 | 14.1 | 1.0 | 9.9 | 6j3 | core, flat | | 1 | |
| 23g10 | core, frag | 12 | 17 | 70.6 | 23g10 | core, frag | 3 | 62.0 | 41.2 | 25.5 | 0.1 | 1.2 | 23g10 | core, frag | | 1 | |
| 21i10 | core, frag | 14 | 21 | 66.7 | 21i10 | core, frag | 7 | 17.4 | 12 | 2.1 | 3.4 | 33.5 | 21i10 | core, frag | | 1 | |
| 10b4 | core, p | 30 | 36 | 83.3 | 10b4 | core, p | 18 | 42 | 20.4 | 8.6 | 2.1 | 21.0 | 10b4 | core, p | | 1 | |
| 10q2 | core, p | 8 | 14 | 57.1 | 10q2 | core, p | 16 | 23.7 | 9.2 | 2.2 | 7.3 | 73.4 | 10q2 | core, p | | | 1 |
| 13b5 | core, p | 10 | 16 | 62.5 | 13b5 | core, p | 10 | 13.8 | 10.7 | 1.5 | 6.8 | 67.7 | 13b5 | core, p | 1 | | |
| 15f5 | core, p | 24 | 29 | 82.8 | 15f5 | core, p | 10 | 62.8 | 60.7 | 38.1 | 0.3 | 2.6 | 15f5 | core, p | | 1 | |
| 15s10 | core, p | 10 | 14 | 71.4 | 15s10 | core, p | 10 | 27.6 | 23.4 | 6.5 | 1.5 | 15.5 | 15s10 | core, p | | 1 | |
| 15s6 | core, p | 5 | 12 | 41.7 | 15s6 | core, p | 7 | 28.5 | 24 | 6.8 | 1.0 | 10.2 | 15s6 | core, p | 1 | | |
| 20ap3 | core, p | 8 | 22 | 36.4 | 20ap3 | core, p | 6 | 45.6 | 24 | 10.9 | 0.5 | 5.5 | 20ap3 | core, p | | 1 | |
| 20aq5 | core, p | 5 | 34 | 14.7 | 20aq5 | core, p | 15 | 12.4 | 9.2 | 1.1 | 13.1 | 131.5 | 20aq5 | core, p | | 1 | |
| 33c3 | core, p | 6 | 22 | 27.3 | 33c3 | core, p | 1 | 30.3 | 22.6 | 6.8 | 0.1 | 1.5 | 33c3 | core, p | 1 | | |
| 35a1 | core, p | 13 | 18 | 72.2 | 35a1 | core, p | 51 | 46.0 | 27.9 | 12.8 | 4.0 | 39.7 | 35a1 | core, p | | 1 | |
| 37f3 | core, p | 7 | 11 | 63.6 | 37f3 | core, p | 10 | 17.0 | 15.1 | 2.6 | 3.9 | 39.0 | 37f3 | core, p | | 1 | |
| 46f5 | core, p | 21 | 28 | 75.0 | 46f5 | core, p | 24 | 11.1 | 8.5 | 0.9 | 25.4 | 254.4 | 46f5 | core, p | | 1 | |
| 46i6 | core, p | 8 | 16 | 50.0 | 46i6 | core, p | 5 | 22.0 | 9.5 | 2.1 | 2.4 | 23.9 | 46i6 | core, p | | 1 | |
| 8d3 | core, p | 8 | 16 | 50.0 | 8d3 | core, p | 22 | 19.6 | 19.6 | 3.8 | 5.7 | 57.3 | 8d3 | core, p | | 1 | |
| 10x3 | core, p | 7 | 31 | 22.6 | 10x3 | core, p | 6 | 28.2 | 23 | 6.5 | 0.9 | 9.3 | 10x3 | core, p | 1 | | |
| 14g2 | core, pi | 7 | 15 | 46.7 | 14g2 | core, pi | 4 | 35.5 | 20.8 | 7.4 | 0.5 | 5.4 | 14g2 | core, pi | | 1 | |
| 15p11 | core, pi | 5 | 12 | 41.7 | 15p11 | core, pi | 2 | 21.5 | 23.4 | 5.0 | 0.4 | 4.0 | 15p11 | core, pi | 1 | | |
| 1k2 | core, pi | 8 | 14 | 57.1 | 1k2 | core, pi | 8 | 16.0 | 11.3 | 1.8 | 4.4 | 44.2 | 1k2 | core, pi | | 1 | |
| 27c9 | core, pi | 12 | 17 | 70.6 | 27c9 | core, pi | 4 | 35.4 | 33.6 | 11.9 | 0.3 | 3.4 | 27c9 | core, pi | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32f6 | core, pi | 7 | 7 | 100.0 | 32f6 | core, pi | 6 | 12.6 | 9.7 | 1.2 | 4.9 | 49.1 | 32f6 | core, pi | | | 1 |
| 36b1 | core, pi | 20 | 25 | 80.0 | 36b1 | core, pi | 12 | 28.7 | 23.2 | 6.7 | 1.8 | 18.0 | 36b1 | core, pi | | 1 | |
| 36f1 | core, pi | 6 | 24 | 25.0 | 36f1 | core, pi | 7 | 15.8 | 15.3 | 2.4 | 2.9 | 29.0 | 36f1 | core, pi | 1 | | |
| 46g3 | core, pi | 6 | 6 | 100.0 | 46g3 | core, pi | 10 | 16.4 | 6.5 | 1.1 | 9.4 | 93.8 | 46g3 | core, pi | | | 1 |
| 50g | core, pi | 6 | 18 | 33.3 | 50g | core, pi | 7 | 28.9 | 26.5 | 7.7 | 0.9 | 9.1 | 50g | core, pi | | 1 | |
| 8b4 | core, pi | 7 | 9 | 77.8 | 8b4 | core, pi | 42 | 28.3 | 28.3 | 8.0 | 5.2 | 52.4 | 8b4 | core, pi | | 1 | |
| S32e5 | core, pi | 6 | 6 | 100.0 | S32e5 | core, pi | 17 | 22.4 | 14.8 | 3.3 | 5.1 | 51.3 | S32e5 | core, pi | | | 1 |
| S6e13 | core, pi | 15 | 19 | 78.9 | S6e13 | core, pi | 14 | 29.7 | 23.3 | 6.9 | 2.0 | 20.2 | S6e13 | core, pi | | 1 | |
| S6e9 | core, pi | 19 | 29 | 65.5 | S6e9 | core, pi | 13 | 24.2 | 18.3 | 4.4 | 2.9 | 29.4 | S6e9 | core, pi | | 1 | |
| 6m3 | core, pi | 1 | 13 | 7.7 | 6m3 | core, pi | 6 | 30 | 24.6 | 7.4 | 0.8 | 8.1 | 6m3 | core, pi | | 1 | |
| 6i3 | core, pi | 8 | 23 | 34.8 | 6i3 | core, pi | 4 | 36 | 19.6 | 7.1 | 0.6 | 5.7 | 6i3 | core, pi | | 1 | |
| 5qsurf3 | core, pi | 6 | 9 | 66.7 | 5qsurf3 | core, pi | 14 | 16.4 | 16.4 | 2.7 | 5.2 | 52.1 | 5qsurf3 | core, pi | | 1 | |
| 14i3 | core, pi | 8 | 13 | 61.5 | 14i3 | core, pi | 20 | 17.3 | 15.7 | 2.7 | 7.4 | 73.6 | 14i3 | core, pi | | | 1 |
| 10aa1 | denticulate | 2 | 7 | 28.6 | 10aa1 | denticulate | 14 | 28 | 18.5 | 5.2 | 2.7 | 27.0 | 10aa1 | denticulate | | 1 | |
| 10p3 | denticulate | 4 | 19 | 21.1 | 10p3 | denticulate | 9 | 26.5 | 21.4 | 5.7 | 1.6 | 15.9 | 10p3 | denticulate | | 1 | |
| 13b3 | denticulate | 1 | 17 | 5.9 | 13b3 | denticulate | 15 | 28.2 | 10.7 | 3.0 | 5.0 | 49.7 | 13b3 | denticulate | 1 | | |
| 14x2 | denticulate | 3 | 17 | 17.6 | 14x2 | denticulate | 1 | 33.6 | 24.7 | 8.3 | 0.1 | 1.2 | 14x2 | denticulate | 1 | | |
| 15f6 | denticulate | 2 | 7 | 28.6 | 15f6 | denticulate | 1 | 23 | 14.7 | 3.4 | 0.3 | 3.0 | 15f6 | denticulate | 1 | | |
| 15L5 | denticulate | 1 | 7 | 14.3 | 15L5 | denticulate | 2 | 21.2 | 19 | 4.0 | 0.5 | 5.0 | 15L5 | denticulate | 1 | | |
| 15L6 | denticulate | 3 | 10 | 30.0 | 15L6 | denticulate | 3 | 25 | 23.4 | 5.9 | 0.5 | 5.1 | 15L6 | denticulate | 1 | | |
| 21q9 | denticulate | 3 | 13 | 23.1 | 21q9 | denticulate | 2 | 33.5 | 31.6 | 10.6 | 0.2 | 1.9 | 21q9 | denticulate | 1 | | |
| 23g9 | denticulate | 7 | 8 | 87.5 | 23g9 | denticulate | 3 | 61.0 | 27.0 | 16.5 | 0.2 | 1.8 | 23g9 | denticulate | | 1 | |
| 27c10 | denticulate | 8 | 16 | 50.0 | 27c10 | denticulate | 4 | 54.4 | 22.6 | 12.3 | 0.3 | 3.3 | 27c10 | denticulate | | 1 | |
| 32f4 | denticulate | 4 | 15 | 26.7 | 32f4 | denticulate | 7 | 42.4 | 36 | 15.3 | 0.5 | 4.6 | 32f4 | denticulate | | | 1 |
| 35a2 | denticulate | 3 | 15 | 20.0 | 35a2 | denticulate | 10 | 15.3 | 15.2 | 2.3 | 4.3 | 43.0 | 35a2 | denticulate | | 1 | |
| 36b6 | denticulate | 8 | 26 | 30.8 | 36b6 | denticulate | 12 | 21.8 | 18.1 | 3.9 | 3.0 | 30.4 | 36b6 | denticulate | | 1 | |
| 36f6 | denticulate | 3 | 14 | 21.4 | 36f6 | denticulate | 4 | 21.4 | 7.5 | 1.6 | 2.5 | 24.9 | 36f6 | denticulate | 1 | | |
| 43a3 | denticulate | 2 | 12 | 16.7 | 43a3 | denticulate | 3 | 26.9 | 16.0 | 4.3 | 0.7 | 7.0 | 43a3 | denticulate | 1 | | |
| 46i1 | denticulate | 3 | 14 | 21.4 | 46i1 | denticulate | 8 | 32.8 | 17.3 | 5.7 | 1.4 | 14.1 | 46i1 | denticulate | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5w6 | denticulate | 7 | 17 | 41.2 | 5w6 | denticulate | 7 | 28.2 | 18.3 | 5.2 | 1.4 | 13.6 | 5w6 | denticulate | 1 | | |
| 6j1 | denticulate | 0 | 9 | 0.0 | 6j1 | denticulate | 7 | 33.5 | 26.5 | 8.9 | 0.8 | 7.9 | 6j1 | denticulate | | 1 | |
| 8a3 | denticulate | 3 | 14 | 21.4 | 8a3 | denticulate | 2 | 38.8 | 22 | 8.5 | 0.2 | 2.3 | 8a3 | denticulate | 1 | | |
| S15e7 | denticulate | 3 | 11 | 27.3 | S15e7 | denticulate | 5 | 27.7 | 18.6 | 5.2 | 1.0 | 9.7 | S15e7 | denticulate | 1 | | |
| 32g2 | flake | 1 | 1 | 100.0 | 32g2 | bip flake | 7 | 34.4 | 18.8 | 6.5 | 1.1 | 10.8 | 32g2 | bip flake | | 1 | |
| 5v1 | flake | 3 | 6 | 50.0 | 5v1 | bip flake | 4 | 30.8 | 15.5 | 4.8 | 0.8 | 8.4 | 5v1 | bip flake | 1 | | |
| 5v2 | flake | 1 | 4 | 25.0 | 5v2 | bip flake | 3 | 37.5 | 12 | 4.5 | 0.7 | 6.7 | 5v2 | bip flake | 1 | | |
| 10ac1 | flake | 0 | 2 | 0.0 | 10ac1 | bip flake | 0 | 19.5 | 19.4 | 3.8 | 0.0 | 0.0 | 10ac1 | bip flake | 1 | | |
| 14x1 | flake | 0 | 3 | 0.0 | 14x1 | bip flake | 1 | 55.6 | 12.6 | 7.0 | 0.1 | 1.4 | 14x1 | bip flake | 1 | | |
| 10q1 | flake | 3 | 4 | 75.0 | 10q1 | flake | 15 | 16 | 6.8 | 1.1 | 13.8 | 137.9 | 10q1 | flake | | | 1 |
| 10w4 | flake | 4 | 5 | 80.0 | 10w4 | flake | 9 | 9.7 | 10.8 | 1.0 | 8.6 | 85.9 | 10w4 | flake | | 1 | |
| 10w6 | flake | 2 | 3 | 66.7 | 10w6 | flake | 14 | 23.8 | 9.6 | 2.3 | 6.1 | 61.3 | 10w6 | flake | | 1 | |
| 13b1 | flake | 3 | 9 | 33.3 | 13b1 | flake | 30 | 32 | 17 | 5.4 | 5.5 | 55.1 | 13b1 | flake | | 1 | |
| 13b2 | flake | 4 | 8 | 50.0 | 13b2 | flake | 31 | 29 | 15.7 | 4.6 | 6.8 | 68.1 | 13b2 | flake | | 1 | |
| 14i1 | flake | 2 | 3 | 66.7 | 14i1 | flake | 7 | 8.7 | 8.1 | 0.7 | 9.9 | 99.3 | 14i1 | flake | | 1 | |
| 15f2 | flake | 5 | 8 | 62.5 | 15f2 | flake | 5 | 34.7 | 22 | 7.6 | 0.7 | 6.5 | 15f2 | flake | | 1 | |
| 15L4 | flake | 2 | 4 | 50.0 | 15L4 | flake | 2 | 22.2 | 12.2 | 2.7 | 0.7 | 7.4 | 15L4 | flake | 1 | | |
| 15L9 | flake | 6 | 13 | 46.2 | 15L9 | flake | 5 | 43.5 | 31.7 | 13.8 | 0.4 | 3.6 | 15L9 | flake | 1 | | |
| 15p6 | flake | 2 | 2 | 100.0 | 15p6 | flake | 3 | 24.7 | 17 | 4.2 | 0.7 | 7.1 | 15p6 | flake | 1 | | |
| 15s1 | flake | 0 | 1 | 0.0 | 15s1 | flake | 3 | 18.3 | 13.3 | 2.4 | 1.2 | 12.3 | 15s1 | flake | 1 | | |
| 15s4 | flake | 3 | 7 | 42.9 | 15s4 | flake | 3 | 19.2 | 18.5 | 3.6 | 0.8 | 8.4 | 15s4 | flake | 1 | | |
| 1k5 | flake | 2 | 2 | 100.0 | 1k5 | flake | 12 | 9.7 | 17.1 | 1.7 | 7.2 | 72.3 | 1k5 | flake | | 1 | |
| 20aq1 | flake | 0 | 3 | 0.0 | 20aq1 | flake | 20 | 16.2 | 14.3 | 2.3 | 8.6 | 86.3 | 20aq1 | flake | | 1 | |
| 20aq3 | flake | 1 | 1 | 100.0 | 20aq3 | flake | 7 | 20.5 | 19.4 | 4.0 | 1.8 | 17.6 | 20aq3 | flake | | | 1 |
| 21i2 | flake | 7 | 10 | 70.0 | 21i2 | flake | 10 | 22.1 | 20.3 | 4.5 | 2.2 | 22.3 | 21i2 | flake | | 1 | |
| 21q4 | flake | 0 | 1 | 0.0 | 21q4 | flake | 1 | 28.2 | 20.2 | 5.7 | 0.2 | 1.8 | 21q4 | flake | 1 | | |
| 23g6 | flake | 1 | 1 | 100.0 | 23g6 | flake | 2 | 40.0 | 29.4 | 11.8 | 0.2 | 1.7 | 23g6 | flake | | | 1 |
| 27c3 | flake | 3 | 4 | 75.0 | 27c3 | flake | 3 | 24.0 | 19.5 | 4.7 | 0.6 | 6.4 | 27c3 | flake | | 1 | |
| 32f1 | flake | 7 | 7 | 100.0 | 32f1 | flake | 4 | 19 | 17 | 3.2 | 1.2 | 12.4 | 32f1 | flake | | | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33c2 | flake | 0 | 3 | 0.0 | 33c2 | flake | 1 | 47.2 | 22.2 | 10.5 | 0.1 | 1.0 | 33c2 | flake | 1 | | |
| 35a3 | flake | 3 | 4 | 75.0 | 35a3 | flake | 11 | 22.2 | 13.3 | 3.0 | 3.7 | 37.3 | 35a3 | flake | | 1 | |
| 35b2 | flake | 1 | 3 | 33.3 | 35b2 | flake | 7 | 30.6 | 26.1 | 8.0 | 0.9 | 8.8 | 35b2 | flake | 1 | | |
| 36b2 | flake | 3 | 3 | 100.0 | 36b2 | flake | 18 | 30.1 | 29.2 | 8.8 | 2.0 | 20.5 | 36b2 | flake | | 1 | |
| 36f2 | flake | 0 | 2 | 0.0 | 36f2 | flake | 19 | 20.3 | 16.5 | 3.3 | 5.7 | 56.7 | 36f2 | flake | 1 | | |
| 37f1 | flake | 1 | 1 | 100.0 | 37f1 | flake | 8 | 17.0 | 16.2 | 2.8 | 2.9 | 29.0 | 37f1 | flake | | 1 | |
| 40b4 | flake | 3 | 3 | 100.0 | 40b4 | flake | 7 | 24.0 | 18.9 | 4.5 | 1.5 | 15.4 | 40b4 | flake | | | 1 |
| 43a4 | flake | 2 | 3 | 66.7 | 43a4 | flake | 10 | 29.8 | 29.5 | 8.8 | 1.1 | 11.4 | 43a4 | flake | 1 | | |
| 46f4 | flake | 3 | 5 | 60.0 | 46f4 | flake | 11 | 12.4 | 9.0 | 1.1 | 9.9 | 98.6 | 46f4 | flake | | 1 | |
| 46g2 | flake | 4 | 4 | 100.0 | 46g2 | flake | 29 | 22.6 | 18.0 | 4.1 | 7.1 | 71.3 | 46g2 | flake | | | 1 |
| 46i5 | flake | 1 | 1 | 100.0 | 46i5 | flake | 14 | 21.5 | 9.5 | 2.0 | 6.9 | 68.5 | 46i5 | flake | | 1 | |
| 46j4 | flake | 3 | 4 | 75.0 | 46j4 | flake | 15 | 8.1 | 8.0 | 0.6 | 23.1 | 231.5 | 46j4 | flake | | 1 | |
| 50g1 | flake | 0 | 4 | 0.0 | 50g | flake | 2 | 18.4 | 9.2 | 1.7 | 1.2 | 11.8 | 50g | flake | 1 | | |
| 50i | flake | 1 | 1 | 100.0 | 50i | flake | 15 | 14.8 | 10.7 | 1.6 | 9.5 | 94.7 | 50i | flake | | | 1 |
| 53b | flake | 0 | 6 | 0.0 | 53b | flake | 1 | 18.0 | 14.0 | 2.5 | 0.4 | 4.0 | 53b | flake | 1 | | |
| 53f1 | flake | 1 | 5 | 20.0 | 53f1 | flake | 3 | 20.4 | 17.0 | 3.5 | 0.9 | 8.7 | 53f1 | flake | 1 | | |
| 54a,c1 | flake | 6 | 6 | 100.0 | 54a,c1 | flake | 16 | 25.0 | 20.0 | 5.0 | 3.2 | 32.0 | 54a,c1 | flake | 1 | | |
| 56b1 | flake | 2 | 7 | 28.6 | 56b1 | flake | 16 | 23.0 | 10.2 | 2.3 | 6.8 | 68.2 | 56b1 | flake | | 1 | |
| 56c1 | flake | 1 | 1 | 100.0 | 56c1 | flake | 18 | 24.8 | 18.0 | 4.5 | 4.0 | 40.3 | 56c1 | flake | | 1 | |
| 5qsurf1 | flake | 4 | 14 | 28.6 | 5qsurf1 | flake | 24 | 27.6 | 13.2 | 3.6 | 6.6 | 65.9 | 5qsurf1 | flake | | 1 | |
| 5stsurf3 | flake | 2 | 6 | 33.3 | 5stsurf3 | flake | 3 | 36.3 | 20 | 7.3 | 0.4 | 4.1 | 5stsurf3 | flake | 1 | | |
| 6b,c3 | flake | 6 | 6 | 100.0 | 6b,c3 | flake | 17 | 20 | 12.3 | 2.5 | 6.9 | 69.1 | 6b,c3 | flake | | 1 | |
| 6i1 | flake | 2 | 5 | 40.0 | 6i1 | flake | 6 | 24.5 | 24.5 | 6.0 | 1.0 | 10.0 | 6i1 | flake | | 1 | |
| 6m1 | flake | 2 | 5 | 40.0 | 6m1 | flake | 3 | 30 | 21.5 | 6.5 | 0.5 | 4.7 | 6m1 | flake | 1 | | |
| 8c1 | flake | 2 | 7 | 28.6 | 8c1 | flake | 4 | 34.8 | 24 | 8.4 | 0.5 | 4.8 | 8c1 | flake | 1 | | |
| 8d1 | flake | 1 | 2 | 50.0 | 8d1 | flake | 12 | 13 | 11.2 | 1.5 | 8.2 | 82.4 | 8d1 | flake | | 1 | |
| 8f2 | flake | 1 | 5 | 20.0 | 8f2 | flake | 5 | 28 | 18 | 5.0 | 1.0 | 9.9 | 8f2 | flake | 1 | | |
| S15e2 | flake | 2 | 9 | 22.2 | S15e2 | flake | 1 | 35 | 30.7 | 10.7 | 0.1 | 0.9 | S15e2 | flake | 1 | | |
| s38e2 | flake | 0 | 3 | 0.0 | s38e2 | flake | 2 | 14.8 | 10.6 | 1.6 | 1.3 | 12.7 | s38e2 | flake | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S6e3 | flake | 7 | 11 | 63.6 | S6e3 | flake | 13 | 43 | 31.8 | 13.7 | 1.0 | 9.5 | S6e3 | flake | | 1 | |
| S6e7 | flake | 10 | 11 | 90.9 | S6e7 | flake | 18 | 63 | 29 | 18.3 | 1.0 | 9.9 | S6e7 | flake | | 1 | |
| S8e1 | flake | 2 | 5 | 40.0 | S8e1 | flake | 6 | 20.3 | 12.6 | 2.6 | 2.3 | 23.5 | S8e1 | flake | | 1 | |
| 15L3 | flake | 0 | 8 | 0.0 | 15L3 | flake | 7 | 23.6 | 12.6 | 3.0 | 2.4 | 23.5 | 15L3 | flake | 1 | | |
| 15p2 | flake | 0 | 2 | 0.0 | 15p2 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p2 | flake | 1 | | |
| 15p3 | flake | 3 | 6 | 50.0 | 15p3 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p3 | flake | 1 | | |
| 15p4 | flake | 1 | 1 | 100.0 | 15p4 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p4 | flake | 1 | | |
| 15p5 | flake | 2 | 4 | 50.0 | 15p5 | flake | 3 | 21 | 16 | 3.4 | 0.9 | 8.9 | 15p5 | flake | 1 | | |
| 15p10 | flake | 3 | 5 | 60.0 | 15p10 | flake | 2 | 33.5 | 22.2 | 7.4 | 0.3 | 2.7 | 15p10 | flake | 1 | | |
| 21i1 | flake | 0 | 9 | 0.0 | 21i1 | flake | 4 | 20.1 | 14.1 | 2.8 | 1.4 | 14.1 | 21i1 | flake | 1 | | |
| 21i3 | flake | 1 | 1 | 100.0 | 21i3 | flake | 22 | 12 | 11.4 | 1.4 | 16.1 | 160.8 | 21i3 | flake | | | 1 |
| 21i4 | flake | 1 | 1 | 100.0 | 21i4 | flake | 5 | 25.3 | 9.6 | 2.4 | 2.1 | 20.6 | 21i4 | flake | | | 1 |
| 21i6 | flake | 3 | 3 | 100.0 | 21i6 | flake | 6 | 29.7 | 28.8 | 8.6 | 0.7 | 7.0 | 21i6 | flake | | 1 | |
| 21q1 | flake | 0 | 1 | 0.0 | 21q1 | flake | 0 | 17.7 | 17.7 | 3.1 | 0.0 | 0.0 | 21q1 | flake | 1 | | |
| 21q3 | flake | 0 | 6 | 0.0 | 21q3 | flake | 0 | 23.5 | 19.8 | 4.7 | 0.0 | 0.0 | 21q3 | flake | 1 | | |
| 21q7 | flake | 2 | 5 | 40.0 | 21q7 | flake | 1 | 29 | 23.2 | 6.7 | 0.1 | 1.5 | 21q7 | flake | 1 | | |
| 21q8 | flake | 4 | 8 | 50.0 | 21q8 | flake | 2 | 29 | 26.3 | 7.6 | 0.3 | 2.6 | 21q8 | flake | 1 | | |
| 14a3 | flake | 4 | 6 | 66.7 | 14a3 | flake | 15 | 40.8 | 26.5 | 10.8 | 1.4 | 13.9 | 14a3 | flake | | 1 | |
| 20ap2 | flake | 1 | 1 | 100.0 | 20ap2 | flake | 7 | 41.6 | 14.5 | 6.0 | 1.2 | 11.6 | 20ap2 | flake | | 1 | |
| 5rsurf2 | flake | 1 | 4 | 25.0 | 5rsurf2 | flake | 9 | 27.7 | 17 | 4.7 | 1.9 | 19.1 | 5rsurf2 | flake | | 1 | |
| 5rsurf3 | flake | 1 | 2 | 50.0 | 5rsurf3 | flake | 7 | 28 | 24.6 | 6.9 | 1.0 | 10.2 | 5rsurf3 | flake | | 1 | |
| S8e2 | flake | 1 | 8 | 12.5 | S8e2 | flake | 1 | 23 | 21 | 4.8 | 0.2 | 2.1 | S8e2 | flake | | 1 | |
| S8e3 | flake | 0 | 2 | 0.0 | S8e3 | flake | 14 | 42.3 | 25.3 | 10.7 | 1.3 | 13.1 | S8e3 | flake | 1 | | |
| 6j2 | flake | 2 | 6 | 33.3 | 6j2 | flake | 12 | 43.7 | 11.5 | 5.0 | 2.4 | 23.9 | 6j2 | flake | 1 | | |
| 6L1 | flake | 4 | 7 | 57.1 | 6L1 | flake | 5 | 27 | 22.5 | 6.1 | 0.8 | 8.2 | 6L1 | flake | | 1 | |
| S11e2 | flake | 1 | 1 | 100.0 | S11e2 | flake | 8 | 32 | 24 | 7.7 | 1.0 | 10.4 | S11e2 | flake | | 1 | |
| 5nsurf1 | flake | 2 | 6 | 33.3 | 5nsurf1 | flake | 10 | 10.5 | 8.8 | 0.9 | 10.8 | 108.2 | 5nsurf1 | flake | | 1 | |
| S6e6 | flake | 6 | 6 | 100.0 | S6e6 | flake | 11 | 34 | 17 | 5.8 | 1.9 | 19.0 | S6e6 | flake | | 1 | |
| 8g2 | flake | 0 | 1 | 0.0 | 8g2 | flake | 16 | 32 | 17 | 5.4 | 2.9 | 29.4 | 8g2 | flake | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8b1 | flake | 1 | 1 | 100.0 | 8b1 | flake | 12 | 19.6 | 13.6 | 2.7 | 4.5 | 45.0 | 8b1 | flake | | 1 | |
| 5w3 | flake | 3 | 11 | 27.3 | 5w3 | flake | 10 | 26.7 | 24.4 | 6.5 | 1.5 | 15.3 | 5w3 | flake | 1 | | |
| 5w1 | flake | 1 | 2 | 50.0 | 5w1 | flake | 3 | 23 | 16.6 | 3.8 | 0.8 | 7.9 | 5w1 | flake | 1 | | |
| 8f1 | flake | 0 | 2 | 0.0 | 8f1 | flake | 4 | 20.4 | 16.3 | 3.3 | 1.2 | 12.0 | 8f1 | flake | 1 | | |
| 5Osurf1 | flake | 1 | 1 | 100.0 | 5Osurf1 | flake | 8 | 22.6 | 13 | 2.9 | 2.7 | 27.2 | 5Osurf1 | flake | | | 1 |
| 5stsurf2 | flake | 0 | 4 | 0.0 | 5stsurf2 | flake | 1 | 28.7 | 19 | 5.5 | 0.2 | 1.8 | 5stsurf2 | flake | 1 | | |
| 8a1 | flake | 0 | 1 | 0.0 | 8a1 | flake | 2 | 21 | 21 | 4.4 | 0.5 | 4.5 | 8a1 | flake | 1 | | |
| 10w1 | flake | 1 | 1 | 100.0 | 10w1 | flake | 5 | 18.3 | 14.5 | 2.7 | 1.9 | 18.8 | 10w1 | flake | | 1 | |
| S32e1 | flake | 2 | 3 | 66.7 | S32e1 | flake | 15 | 15.5 | 15.5 | 2.4 | 6.2 | 62.4 | S32e1 | flake | | | 1 |
| S32e2 | flake | 2 | 2 | 100.0 | S32e2 | flake | 20 | 19 | 19 | 3.6 | 5.5 | 55.4 | S32e2 | flake | | | 1 |
| 10b1 | retouch | 6 | 20 | 30.0 | 10b1 | retouch | 5 | 32.4 | 32.3 | 10.5 | 0.5 | 4.8 | 10b1 | retouch | 1 | | |
| 10b2 | retouch | 4 | 17 | 23.5 | 10b2 | retouch | 6 | 36.2 | 28 | 10.1 | 0.6 | 5.9 | 10b2 | retouch | | 1 | |
| 10w2 | retouch | 0 | 11 | 0.0 | 10w2 | retouch | 4 | 25.2 | 16.6 | 4.2 | 1.0 | 9.6 | 10w2 | retouch | | 1 | |
| 10w3 | retouch | 7 | 13 | 53.8 | 10w3 | retouch | 14 | 9 | 16 | 1.4 | 9.7 | 97.2 | 10w3 | retouch | | 1 | |
| 14i2 | retouch | 2 | 12 | 16.7 | 14i2 | retouch | 10 | 19.5 | 8 | 1.6 | 6.4 | 64.1 | 14i2 | retouch | | 1 | |
| 14i3 | retouch | 10 | 10 | 100.0 | 14i3 | retouch | 15 | 10.7 | 8.5 | 0.9 | 16.5 | 164.9 | 14i3 | retouch | | | 1 |
| 15f7 | retouch | 3 | 22 | 13.6 | 15f7 | retouch | 1 | 35.2 | 24.8 | 8.7 | 0.1 | 1.1 | 15f7 | retouch | 1 | | |
| 15L2 | retouch | 1 | 8 | 12.5 | 15L2 | retouch | 2 | 21.5 | 10 | 2.2 | 0.9 | 9.3 | 15L2 | retouch | 1 | | |
| 15L8 | retouch | 0 | 19 | 0.0 | 15L8 | retouch | 6 | 39.5 | 24.2 | 9.6 | 0.6 | 6.3 | 15L8 | retouch | 1 | | |
| 15p8 | retouch | 2 | 16 | 12.5 | 15p8 | retouch | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p8 | retouch | 1 | | |
| 15s5 | retouch | 4 | 14 | 28.6 | 15s5 | retouch | 4 | 22 | 16.8 | 3.7 | 1.1 | 10.8 | 15s5 | retouch | | 1 | |
| 15s7 | retouch | 5 | 21 | 23.8 | 15s7 | retouch | 2 | 20.7 | 14.4 | 3.0 | 0.7 | 6.7 | 15s7 | retouch | | 1 | |
| 1k4 | retouch | 0 | 9 | 0.0 | 1k4 | retouch | 5 | 14.1 | 11.4 | 1.6 | 3.1 | 31.1 | 1k4 | retouch | 1 | | |
| 20aq4 | retouch | 2 | 9 | 22.2 | 20aq4 | retouch | 22 | 23 | 12.6 | 2.9 | 7.6 | 75.9 | 20aq4 | retouch | | 1 | |
| 21i9 | retouch | 2 | 13 | 15.4 | 21i9 | retouch | 12 | 40.4 | 18 | 7.3 | 1.7 | 16.5 | 21i9 | retouch | | 1 | |
| 21q2 | retouch | 0 | 20 | 0.0 | 21q2 | retouch | 0 | 24 | 20.5 | 4.9 | 0.0 | 0.0 | 21q2 | retouch | 1 | | |
| 23g3 | retouch | 2 | 5 | 40.0 | 23g3 | retouch | 2 | 27.1 | 25.0 | 6.8 | 0.3 | 3.0 | 23g3 | retouch | | 1 | |
| 27c1 | retouch | 0 | 17 | 0.0 | 27c1 | retouch | 2 | 18.1 | 12.5 | 2.3 | 0.9 | 8.8 | 27c1 | retouch | 1 | | |
| 32f3 | retouch | 4 | 8 | 50.0 | 32f3 | retouch | 10 | 38 | 34.2 | 13.0 | 0.8 | 7.7 | 32f3 | retouch | | | 1 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32f5 | retouch | 3 | 6 | 50.0 | 32f5 | retouch | 6 | 44 | 28.6 | 12.6 | 0.5 | 4.8 | 32f5 | retouch | | | 1 |
| 35a6 | retouch | 2 | 7 | 28.6 | 35a6 | retouch | 3 | 27.3 | 17.6 | 4.8 | 0.6 | 6.2 | 35a6 | retouch | | 1 | |
| 35b4 | retouch | 2 | 12 | 16.7 | 35b4 | retouch | 6 | 25.4 | 23.6 | 6.0 | 1.0 | 10.0 | 35b4 | retouch | | 1 | |
| 36b4 | retouch | 5 | 19 | 26.3 | 36b4 | retouch | 13 | 46.2 | 19.4 | 9.0 | 1.5 | 14.5 | 36b4 | retouch | 1 | | |
| 36f4 | retouch | 4 | 17 | 23.5 | 36f4 | retouch | 8 | 14.6 | 14.0 | 2.0 | 3.9 | 39.1 | 36f4 | retouch | 1 | | |
| 37f4 | retouch | 8 | 29 | 27.6 | 37f4 | retouch | 6 | 12.5 | 10.2 | 1.3 | 4.7 | 47.1 | 37f4 | retouch | | 1 | |
| 40b3 | retouch | 15 | 20 | 75.0 | 40b3 | retouch | 18 | 30.6 | 11.8 | 3.6 | 5.0 | 49.9 | 40b3 | retouch | | | 1 |
| 43a5 | retouch | 7 | 25 | 28.0 | 43a5 | retouch | 9 | 30.0 | 26.1 | 7.8 | 1.1 | 11.5 | 43a5 | retouch | 1 | | |
| 46f2 | retouch | 2 | 13 | 15.4 | 46f2 | retouch | 8 | 5.0 | 5.0 | 0.3 | 32.0 | 320.0 | 46f2 | retouch | | | 1 |
| 46g1 | retouch | 1 | 8 | 12.5 | 46g1 | retouch | 10 | 7.2 | 6.5 | 0.5 | 21.4 | 213.7 | 46g1 | retouch | | | 1 |
| 46i3 | retouch | 3 | 16 | 18.8 | 46i3 | retouch | 6 | 24.4 | 23.8 | 5.8 | 1.0 | 10.3 | 46i3 | retouch | | 1 | |
| 46j2 | retouch | 7 | 13 | 53.8 | 46j2 | retouch | 13 | 11.1 | 10.6 | 1.2 | 11.0 | 110.5 | 46j2 | retouch | | 1 | |
| 50g | retouch | 5 | 12 | 41.7 | 50g | retouch | 2 | 22.2 | 14.8 | 3.3 | 0.6 | 6.1 | 50g | retouch | | 1 | |
| 53b | retouch | 6 | 18 | 33.3 | 53b | retouch | 6 | 32.6 | 14.3 | 4.7 | 1.3 | 12.9 | 53b | retouch | | 1 | |
| 53f | retouch | 0 | 27 | 0.0 | 53f | retouch | 3 | 27.6 | 19.6 | 5.4 | 0.6 | 5.5 | 53f | retouch | 1 | | |
| 54a,c4 | retouch | 3 | 21 | 14.3 | 54a,c4 | retouch | 24 | 16.0 | 16.0 | 2.6 | 9.4 | 93.8 | 54a,c4 | retouch | | 1 | |
| 56b4 | retouch | 6 | 18 | 33.3 | 56b4 | retouch | 12 | 22.5 | 19.4 | 4.4 | 2.7 | 27.5 | 56b4 | retouch | | 1 | |
| 56c4 | retouch | 2 | 27 | 7.4 | 56c4 | retouch | 9 | 21.1 | 16.4 | 3.5 | 2.6 | 26.0 | 56c4 | retouch | 1 | | |
| 5hsurf2 | retouch | 5 | 15 | 33.3 | 5hsurf2 | retouch | 8 | 37.4 | 26 | 9.7 | 0.8 | 8.2 | 5hsurf2 | retouch | | 1 | |
| 5msurf3 | retouch | 3 | 21 | 14.3 | 5msurf3 | retouch | 1 | 42.5 | 32.2 | 13.7 | 0.1 | 0.7 | 5msurf3 | retouch | 1 | | |
| 5nsurf6 | retouch | 2 | 11 | 18.2 | 5nsurf6 | retouch | 11 | 26.6 | 17.5 | 4.7 | 2.4 | 23.6 | 5nsurf6 | retouch | 1 | | |
| 5usurf1 | retouch | 2 | 12 | 16.7 | 5usurf1 | retouch | 18 | 27.5 | 22 | 6.1 | 3.0 | 29.8 | 5usurf1 | retouch | | 1 | |
| 5usurf2 | retouch | 3 | 18 | 16.7 | 5usurf2 | retouch | 15 | 31.6 | 21.7 | 6.9 | 2.2 | 21.9 | 5usurf2 | retouch | 1 | | |
| 6n1 | retouch | 0 | 15 | 0.0 | 6n1 | retouch | 1 | 22 | 20 | 4.4 | 0.2 | 2.3 | 6n1 | retouch | 1 | | |
| 8b5 | retouch | 1 | 11 | 9.1 | 8b5 | retouch | 7 | 20.7 | 15.7 | 3.2 | 2.2 | 21.5 | 8b5 | retouch | | | 1 |
| 8d2 | retouch | 1 | 16 | 6.3 | 8d2 | retouch | 15 | 16.5 | 11 | 1.8 | 8.3 | 82.6 | 8d2 | retouch | | 1 | |
| 8g1 | retouch | 2 | 7 | 28.6 | 8g1 | retouch | 21 | 27 | 15.8 | 4.3 | 4.9 | 49.2 | 8g1 | retouch | | 1 | |
| 8g3 | retouch | 3 | 13 | 23.1 | 8g3 | retouch | 11 | 32.8 | 17 | 5.6 | 2.0 | 19.7 | 8g3 | retouch | | 1 | |
| S11e1 | retouch | 2 | 17 | 11.8 | S11e1 | retouch | 1 | 18.4 | 12 | 2.2 | 0.5 | 4.5 | S11e1 | retouch | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S15e3 | retouch | 2 | 21 | 9.5 | S15e3 | retouch | 4 | 54.3 | 41 | 22.3 | 0.2 | 1.8 | S15e3 | retouch | 1 | | |
| s38e4 | retouch | 1 | 10 | 10.0 | s38e4 | retouch | 5 | 16.3 | 16.2 | 2.6 | 1.9 | 18.9 | s38e4 | retouch | 1 | | |
| S6e12 | retouch | 7 | 21 | 33.3 | S6e12 | retouch | 17 | 25.7 | 21.7 | 5.6 | 3.0 | 30.5 | S6e12 | retouch | | 1 | |
| S6e5 | retouch | 3 | 18 | 16.7 | S6e5 | retouch | 17 | 44 | 33 | 14.5 | 1.2 | 11.7 | S6e5 | retouch | | 1 | |
| S6e1 | retouch | 7 | 12 | 58.3 | S6e1 | retouch | 15 | 45.2 | 21.8 | 9.9 | 1.5 | 15.2 | S6e1 | retouch | | 1 | |
| 10p2 | scraper | 5 | 20 | 25.0 | 10p2 | scraper | 16 | 43 | 27.4 | 11.8 | 1.4 | 13.6 | 10p2 | scraper | | 1 | |
| 10q4 | scraper | 1 | 10 | 10.0 | 10q4 | scraper | 6 | 19 | 15.5 | 2.9 | 2.0 | 20.4 | 10q4 | scraper | | | 1 |
| 10w7 | scraper | 7 | 15 | 46.7 | 10w7 | scraper | 7 | 11.9 | 6.2 | 0.7 | 9.5 | 94.9 | 10w7 | scraper | | 1 | |
| 10w8 | scraper | 5 | 12 | 41.7 | 10w8 | scraper | 10 | 25.4 | 9.3 | 2.4 | 4.2 | 42.3 | 10w8 | scraper | | 1 | |
| 10x1 | scraper | 1 | 16 | 6.3 | 10x1 | scraper | 0 | 18 | 18 | 3.2 | 0.0 | 0.0 | 10x1 | scraper | 1 | | |
| 13b4 | scraper | 4 | 9 | 44.4 | 13b4 | scraper | 14 | 11.5 | 8.1 | 0.9 | 15.0 | 150.3 | 13b4 | scraper | 1 | | |
| 15f3 | scraper | 15 | 17 | 88.2 | 15f3 | scraper | 4 | 31 | 19.6 | 6.1 | 0.7 | 6.6 | 15f3 | scraper | | 1 | |
| 15L11 | scraper | 5 | 11 | 45.5 | 15L11 | scraper | 3 | 15.2 | 14.6 | 2.2 | 1.4 | 13.5 | 15L11 | scraper | 1 | | |
| 15L7 | scraper | 4 | 10 | 40.0 | 15L7 | scraper | 3 | 31.2 | 26.7 | 8.3 | 0.4 | 3.6 | 15L7 | scraper | 1 | | |
| 15p7 | scraper | 0 | 10 | 0.0 | 15p7 | scraper | 1 | 22 | 15 | 3.3 | 0.3 | 3.0 | 15p7 | scraper | 1 | | |
| 15s8 | scraper | 8 | 20 | 40.0 | 15s8 | scraper | 7 | 37.4 | 27.8 | 10.4 | 0.7 | 6.7 | 15s8 | scraper | | 1 | |
| 15s9 | scraper | 9 | 19 | 47.4 | 15s9 | scraper | 7 | 26 | 20 | 5.2 | 1.3 | 13.5 | 15s9 | scraper | | 1 | |
| 1k1 | scraper | 6 | 17 | 35.3 | 1k1 | scraper | 7 | 19.7 | 12.4 | 2.4 | 2.9 | 28.7 | 1k1 | scraper | | 1 | |
| 20aq2 | scraper | 1 | 15 | 6.7 | 20aq2 | scraper | 10 | 15 | 7 | 1.1 | 9.5 | 95.2 | 20aq2 | scraper | | 1 | |
| 21i7 | scraper | 13 | 25 | 52.0 | 21i7 | scraper | 6 | 15.2 | 14 | 2.1 | 2.8 | 28.2 | 21i7 | scraper | | 1 | |
| 21q6 | scraper | 0 | 13 | 0.0 | 21q6 | scraper | 1 | 33.8 | 16 | 5.4 | 0.2 | 1.8 | 21q6 | scraper | 1 | | |
| 23g2 | scraper | 11 | 18 | 61.1 | 23g2 | scraper | 2 | 27.1 | 23.0 | 6.2 | 0.3 | 3.2 | 23g2 | scraper | | 1 | |
| 27c7 | scraper | 5 | 20 | 25.0 | 27c7 | scraper | 4 | 34.0 | 24.6 | 8.4 | 0.5 | 4.8 | 27c7 | scraper | | 1 | |
| 35a5 | scraper | 5 | 15 | 33.3 | 35a5 | scraper | 11 | 32.3 | 18.5 | 6.0 | 1.8 | 18.4 | 35a5 | scraper | | 1 | |
| 35b5 | scraper | 5 | 30 | 16.7 | 35b5 | scraper | 9 | 33.6 | 24.7 | 8.3 | 1.1 | 10.8 | 35b5 | scraper | 1 | | |
| 36b5 | scraper | 2 | 15 | 13.3 | 36b5 | scraper | 15 | 22.2 | 14.0 | 3.1 | 4.8 | 48.3 | 36b5 | scraper | | 1 | |
| 36f5 | scraper | 4 | 22 | 18.2 | 36f5 | scraper | 6 | 17.0 | 9.8 | 1.7 | 3.6 | 36.0 | 36f5 | scraper | 1 | | |
| 37f5 | scraper | 2 | 14 | 14.3 | 37f5 | scraper | 7 | 25.0 | 21.1 | 5.3 | 1.3 | 13.3 | 37f5 | scraper | 1 | | |
| 40b5 | scraper | 6 | 15 | 40.0 | 40b5 | scraper | 9 | 29.1 | 10.2 | 3.0 | 3.0 | 30.3 | 40b5 | scraper | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43a2 | scraper | 5 | 27 | 18.5 | 43a2 | scraper | 9 | 31.7 | 26.9 | 8.5 | 1.1 | 10.6 | 43a2 | scraper | | 1 | |
| 46f1 | scraper | 8 | 15 | 53.3 | 46f1 | scraper | 7 | 17.0 | 13.0 | 2.2 | 3.2 | 31.7 | 46f1 | scraper | | | 1 |
| 46h1 | scraper | 4 | 9 | 44.4 | 46k1 | scraper | 12 | 20.6 | 15.0 | 3.1 | 3.9 | 38.8 | 46k1 | scraper | | | 1 |
| 46i2 | scraper | 0 | 22 | 0.0 | 46i2 | scraper | 7 | 17.8 | 11.3 | 2.0 | 3.5 | 34.8 | 46i2 | scraper | 1 | | |
| 46j1 | scraper | 10 | 17 | 58.8 | 46j1 | scraper | 13 | 10.6 | 9.5 | 1.0 | 12.9 | 129.1 | 46j1 | scraper | | 1 | |
| 50f | scraper | 5 | 10 | 50.0 | 50f | scraper | 5 | 40.0 | 26.7 | 10.7 | 0.5 | 4.7 | 50f | scraper | | 1 | |
| 53b | scraper | 11 | 28 | 39.3 | 53b | scraper | 9 | 38.7 | 32.2 | 12.5 | 0.7 | 7.2 | 53b | scraper | | 1 | |
| 53f2 | scraper | 1 | 11 | 9.1 | 53f2 | scraper | 1 | 22.2 | 18.1 | 4.0 | 0.2 | 2.5 | 53f2 | scraper | 1 | | |
| 54a,c3 | scraper | 18 | 30 | 60.0 | 54a,c3 | scraper | 13 | 24.0 | 16.4 | 3.9 | 3.3 | 33.0 | 54a,c3 | scraper | | 1 | |
| 56b3 | scraper | 3 | 12 | 25.0 | 56b3 | scraper | 14 | 29.3 | 8.4 | 2.5 | 5.7 | 56.9 | 56b3 | scraper | | | 1 |
| 56c3 | scraper | 11 | 23 | 47.8 | 56c3 | scraper | 6 | 22.0 | 13.7 | 3.0 | 2.0 | 19.9 | 56c3 | scraper | 1 | | |
| 5msurf1 | scraper | 7 | 23 | 30.4 | 5msurf1 | scraper | 1 | 37.7 | 34.5 | 13.0 | 0.1 | 0.8 | 5msurf1 | scraper | 1 | | |
| 5nsurf2 | scraper | 1 | 20 | 5.0 | 5nsurf2 | scraper | 16 | 18.7 | 14.5 | 2.7 | 5.9 | 59.0 | 5nsurf2 | scraper | | 1 | |
| 5Osurf2 | scraper | 10 | 17 | 58.8 | 5Osurf2 | scraper | 26 | 12.5 | 12.5 | 1.6 | 16.6 | 166.4 | 5Osurf2 | scraper | | | 1 |
| 5qsurf2 | scraper | 6 | 18 | 33.3 | 5qsurf2 | scraper | 19 | 24.7 | 12.3 | 3.0 | 6.3 | 62.5 | 5qsurf2 | scraper | | 1 | |
| 5usurf3 | scraper | 4 | 26 | 15.4 | 5usurf3 | scraper | 4 | 31.7 | 24 | 7.6 | 0.5 | 5.3 | 5usurf3 | scraper | 1 | | |
| 6b,c2 | scraper | 7 | 21 | 33.3 | 6b,c2 | scraper | 5 | 25.8 | 24.2 | 6.2 | 0.8 | 8.0 | 6b,c2 | scraper | 1 | | |
| 6k1 | scraper | 4 | 17 | 23.5 | 6k1 | scraper | 11 | 31.2 | 26.5 | 8.3 | 1.3 | 13.3 | 6k1 | scraper | 1 | | |
| 6L3 | scraper | 3 | 16 | 18.8 | 6L3 | scraper | 3 | 34 | 22 | 7.5 | 0.4 | 4.0 | 6L3 | scraper | | 1 | |
| 6n2 | scraper | 1 | 24 | 4.2 | 6n2 | scraper | 1 | 50 | 28.6 | 14.3 | 0.1 | 0.7 | 6n2 | scraper | 1 | | |
| 8b3 | scraper | 13 | 13 | 100.0 | 8b3 | scraper | 11 | 21.4 | 12 | 2.6 | 4.3 | 42.8 | 8b3 | scraper | | | 1 |
| 8g4 | scraper | 6 | 13 | 46.2 | 8g4 | scraper | 32 | 35.5 | 26.8 | 9.5 | 3.4 | 33.6 | 8g4 | scraper | | 1 | |
| S15e4 | scraper | 21 | 38 | 55.3 | S15e4 | scraper | 4 | 58.8 | 34 | 20.0 | 0.2 | 2.0 | S15e4 | scraper | | 1 | |
| S32e3 | scraper | 6 | 10 | 60.0 | S32e3 | scraper | 17 | 11.5 | 11.3 | 1.3 | 13.1 | 130.8 | S32e3 | scraper | | | 1 |
| S32e4 | scraper | 13 | 17 | 76.5 | S32e4 | scraper | 12 | 17.3 | 14 | 2.4 | 5.0 | 49.5 | S32e4 | scraper | | | 1 |
| s38e5 | scraper | 0 | 22 | 0.0 | s38e5 | scraper | 2 | 22.8 | 11.8 | 2.7 | 0.7 | 7.4 | s38e5 | scraper | 1 | | |
| S6e10 | scraper | 11 | 21 | 52.4 | S6e10 | scraper | 13 | 51.4 | 39.5 | 20.3 | 0.6 | 6.4 | S6e10 | scraper | | 1 | |
| S6e4 | scraper | 2 | 25 | 8.0 | S6e4 | scraper | 13 | 46.5 | 26.3 | 12.2 | 1.1 | 10.6 | S6e4 | scraper | | 1 | |
| 14a2 | scraper | 4 | 15 | 26.7 | 14a2 | scraper | 21 | 28 | 19.5 | 5.5 | 3.8 | 38.5 | 14a2 | scraper | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20ap1 | scraper | 4 | 20 | 20.0 | 20ap1 | scraper | 5 | 36.3 | 23.5 | 8.5 | 0.6 | 5.9 | 20ap1 | scraper | 1 | | |
| 5hsurf1 | scraper | 1 | 21 | 4.8 | 5hsurf1 | scraper | 0 | 24.4 | 16.6 | 4.1 | 0.0 | 0.0 | 5hsurf1 | scraper | 1 | | |
| 6m2 | scraper | 1 | 14 | 7.1 | 6m2 | scraper | 3 | 27 | 24.5 | 6.6 | 0.5 | 4.5 | 6m2 | scraper | 1 | | |
| S11e3 | scraper | 2 | 19 | 10.5 | S11e3 | scraper | 4 | 28.4 | 14.3 | 4.1 | 1.0 | 9.8 | S11e3 | scraper | | 1 | |
| 10b3 | scraper | 16 | 22 | 72.7 | 10b3 | scraper | 4 | 17 | 16 | 2.7 | 1.5 | 14.7 | 10b3 | scraper | | 1 | |
| 14g1 | scraper | 6 | 16 | 37.5 | 14g1 | scraper | 4 | 40.5 | 16.6 | 6.7 | 0.6 | 5.9 | 14g1 | scraper | | 1 | |
| 32g3 | scraper | 3 | 10 | 30.0 | 32g3 | scraper | 12 | 35.3 | 32.3 | 11.4 | 1.1 | 10.5 | 32g3 | scraper | | 1 | |
| 6i2 | scraper | 7 | 25 | 28.0 | 6i2 | scraper | 4 | 23 | 11.5 | 2.6 | 1.5 | 15.1 | 6i2 | scraper | | 1 | |
| 5nsurf4 | scraper | 5 | 23 | 21.7 | 5nsurf4 | scraper | 18 | 29.2 | 15 | 4.4 | 4.1 | 41.1 | 5nsurf4 | scraper | | 1 | |
| S6e8 | scraper | 12 | 23 | 52.2 | S6e8 | scraper | 11 | 47.2 | 12.8 | 6.0 | 1.8 | 18.2 | S6e8 | scraper | | 1 | |
| 5w2 | scraper | 6 | 19 | 31.6 | 5w2 | scraper | 4 | 27.5 | 27 | 7.4 | 0.5 | 5.4 | 5w2 | scraper | 1 | | |
| 10x2 | scraper | 3 | 16 | 18.8 | 10x2 | scraper | 5 | 30 | 26.6 | 8.0 | 0.6 | 6.3 | 10x2 | scraper | 1 | | |
| 8c2 | scraper | 11 | 18 | 61.1 | 8c2 | scraper | 10 | 38.8 | 34 | 13.2 | 0.8 | 7.6 | 8c2 | scraper | | 1 | |
| 20, O1 | scraper | 3 | 21 | 14.3 | 20, O1 | scraper | 1 | 35.7 | 33.3 | 11.9 | 0.1 | 0.8 | 20, O1 | scraper | 1 | | |
| 5stsurf1 | scraper | 0 | 16 | 0.0 | 5stsurf1 | scraper | 2 | 25 | 14 | 3.5 | 0.6 | 5.7 | 5stsurf1 | scraper | 1 | | |
| 8a2 | scraper | 8 | 17 | 47.1 | 8a2 | scraper | 2 | 29.2 | 26.3 | 7.7 | 0.3 | 2.6 | 8a2 | scraper | 1 | | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **347** | | | | 45.0% | **347** | | | | | | | 30.2 | **347** | | 131 | 166 | 50 |
| | | | | | | | | | | | | | | Percentage of sample | 37.8 | 47.8 | 14.4 |

**Table 15: Experimental Oldowan chert raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| Sn | Tt | Iscar | Dscar | % F | Sn | Tt | f | L, mm | w, mm | a cm2 | f/cm2 | f/10 cm2 | Sn | Tt | N | S | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10h11 | chunk | 3 | 3 | 100.0 | 10h11 | chunk | 11 | 21.3 | 16.3 | 3.5 | 3.2 | 31.7 | 10h11 | chunk | | 1 | |
| 10h12 | chunk | 5 | 5 | 100.0 | 10h12 | chunk | 8 | 21.7 | 18.5 | 4.0 | 2.0 | 19.9 | 10h12 | chunk | | 1 | |
| 10m11 | chunk | 3 | 6 | 50.0 | 10m11 | chunk | 3 | 13.9 | 12.5 | 1.7 | 1.7 | 17.3 | 10m11 | chunk | | 1 | |
| 10m5 | chunk | 3 | 3 | 100.0 | 10m5 | chunk | 3 | 27.7 | 16.3 | 4.5 | 0.7 | 6.6 | 10m5 | chunk | | 1 | |
| 10r6 | chunk | 3 | 12 | 25.0 | 10r6 | chunk | 8 | 38.3 | 30.0 | 11.5 | 0.7 | 7.0 | 10r6 | chunk | | 1 | |
| 10s11 | chunk | 1 | 3 | 33.3 | 10s11 | chunk | 5 | 27.2 | 17.3 | 4.7 | 1.1 | 10.6 | 10s11 | chunk | | | 1 |
| 10s12 | chunk | 3 | 3 | 100.0 | 10s12 | chunk | 4 | 17.8 | 13.5 | 2.4 | 1.7 | 16.6 | 10s12 | chunk | | | 1 |
| 11a11 | chunk | 6 | 6 | 100.0 | 11a11 | chunk | 10 | 27.2 | 16.7 | 4.5 | 2.2 | 22.0 | 11a11 | chunk | | 1 | |
| 11a4 | chunk | 6 | 9 | 66.7 | 11a4 | chunk | 5 | 28.9 | 26.8 | 7.7 | 0.6 | 6.5 | 11a4 | chunk | | | 1 |
| 11b6 | chunk | 2 | 6 | 33.3 | 11b6 | chunk | 1 | 31.2 | 21.3 | 6.6 | 0.2 | 1.5 | 11b6 | chunk | | | 1 |
| 14k6 | chunk | 7 | 9 | 77.8 | 14k6 | chunk | 5 | 32.0 | 25.2 | 8.1 | 0.6 | 6.2 | 14k6 | chunk | | | 1 |
| 14L3 | chunk | 0 | 6 | 0.0 | 14L3 | chunk | 2 | 17.7 | 14.2 | 2.5 | 0.8 | 8.0 | 14L3 | chunk | | | 1 |
| 14m2 | chunk | 4 | 12 | 33.3 | 14m2 | chunk | 3 | 56.8 | 27.8 | 15.8 | 0.2 | 1.9 | 14m2 | chunk | | 1 | |
| 15a13 | chunk | 3 | 3 | 100.0 | 15a13 | chunk | 2 | 23.3 | 18.8 | 4.4 | 0.5 | 4.6 | 15a13 | chunk | | 1 | |
| 15a14 | chunk | 1 | 1 | 100.0 | 15a14 | chunk | 4 | 55.7 | 32.0 | 17.8 | 0.2 | 2.2 | 15a14 | chunk | | 1 | |
| 15b2 | chunk | 10 | 10 | 100.0 | 15b2 | chunk | 4 | 17.7 | 15.6 | 2.8 | 1.4 | 14.5 | 15b2 | chunk | | 1 | |
| 15b9 | chunk | 9 | 9 | 100.0 | 15b9 | chunk | 9 | 19.5 | 19.5 | 3.8 | 2.4 | 23.7 | 15b9 | chunk | | 1 | |
| 15g5 | chunk | 6 | 6 | 100.0 | 15g5 | chunk | 1 | 41.4 | 31.4 | 13.0 | 0.1 | 0.8 | 15g5 | chunk | | | 1 |
| 15i4 | chunk | 2 | 6 | 33.3 | 15i4 | chunk | 4 | 18.0 | 11.4 | 2.1 | 1.9 | 19.5 | 15i4 | chunk | | 1 | |
| 15i9 | chunk | 4 | 4 | 100.0 | 15i9 | chunk | 14 | 60.0 | 23.6 | 14.2 | 1.0 | 9.9 | 15i9 | chunk | | 1 | |
| 15k1 | chunk | 1 | 2 | 50.0 | 15k1 | chunk | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15k1 | chunk | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15k6 | chunk | 4 | 8 | 50.0 | 15k6 | chunk | 1 | 21.1 | 19.7 | 4.2 | 0.2 | 2.4 | 15k6 | chunk | | 1 | |
| 16a2 | chunk | 5 | 6 | 83.3 | 16a2 | chunk | 1 | 20.6 | 16.0 | 3.3 | 0.3 | 3.0 | 16a2 | chunk | | 1 | |
| 16a8 | chunk | 11 | 11 | 100.0 | 16a8 | chunk | 5 | 26.0 | 20.0 | 5.2 | 1.0 | 9.6 | 16a8 | chunk | | 1 | |
| 16c12 | chunk | 6 | 6 | 100.0 | 16c12 | chunk | 1 | 21.1 | 18.4 | 3.9 | 0.3 | 2.6 | 16c12 | chunk | 1 | | |
| 16f11 | chunk | 1 | 4 | 25.0 | 16f11 | chunk | 2 | 21.0 | 19.3 | 4.1 | 0.5 | 4.9 | 16f11 | chunk | | 1 | |
| 16f2 | chunk | 2 | 7 | 28.6 | 16f2 | chunk | 5 | 22.2 | 16.6 | 3.7 | 1.4 | 13.6 | 16f2 | chunk | | 1 | |
| 16g1 | chunk | 2 | 6 | 33.3 | 16g1 | chunk | 3 | 27.2 | 25.5 | 6.9 | 0.4 | 4.3 | 16g1 | chunk | | 1 | |
| 17a,b,c2 | chunk | 2 | 7 | 28.6 | 17a,b,c2 | chunk | 2 | 21.2 | 12.4 | 2.6 | 0.8 | 7.6 | 17a,b,c2 | chunk | | 1 | |
| 17a,b,c5 | chunk | 10 | 11 | 90.9 | 17a,b,c5 | chunk | 4 | 49.4 | 22.7 | 11.2 | 0.4 | 3.6 | 17a,b,c5 | chunk | | | 1 |
| 18a4 | chunk | 9 | 14 | 64.3 | 18a4 | chunk | 14 | 23.5 | 18.7 | 4.4 | 3.2 | 31.9 | 18a4 | chunk | | 1 | |
| 18b1 | chunk | 0 | 7 | 0.0 | 18b1 | chunk | 4 | 14.3 | 14.3 | 2.0 | 2.0 | 19.6 | 18b1 | chunk | | 1 | |
| 18b11 | chunk | 6 | 9 | 66.7 | 18b11 | chunk | 7 | 25.7 | 16.4 | 4.2 | 1.7 | 16.6 | 18b11 | chunk | | 1 | |
| 18c12 | chunk | 3 | 5 | 60.0 | 18c12 | chunk | 7 | 17.3 | 13.6 | 2.4 | 3.0 | 29.8 | 18c12 | chunk | | 1 | |
| 18c9 | chunk | 9 | 15 | 60.0 | 18c9 | chunk | 16 | 46.3 | 33.4 | 15.5 | 1.0 | 10.3 | 18c9 | chunk | | 1 | |
| 19d13 | chunk | 1 | 6 | 16.7 | 19d13 | chunk | 4 | 16.6 | 13.5 | 2.2 | 1.8 | 17.8 | 19d13 | chunk | | 1 | |
| 19d14 | chunk | 2 | 5 | 40.0 | 19d14 | chunk | 3 | 18.6 | 15.9 | 3.0 | 1.0 | 10.1 | 19d14 | chunk | | 1 | |
| 19f/g5 | chunk | 1 | 6 | 16.7 | 19f/g5 | chunk | 5 | 26.0 | 14.7 | 3.8 | 1.3 | 13.1 | 19f/g5 | chunk | 1 | | |
| 1a7 | chunk | 4 | 5 | 80.0 | 1a7 | chunk | 3 | 20.9 | 19.3 | 4.0 | 0.7 | 7.4 | 1a7 | chunk | | 1 | |
| 1c4 | chunk | 2 | 2 | 100.0 | 1c4 | chunk | 4 | 22.1 | 14.0 | 3.1 | 1.3 | 12.9 | 1c4 | chunk | 1 | | |
| 1d1 | chunk | 2 | 4 | 50.0 | 1d1 | chunk | 0 | 29.5 | 17.6 | 5.2 | 0.0 | 0.0 | 1d1 | chunk | | 1 | |
| 1i/j2 | chunk | 5 | 5 | 100.0 | 1i/j2 | chunk | 2 | 25.0 | 22.2 | 5.6 | 0.4 | 3.6 | 1i/j2 | chunk | 1 | | |
| 20af3 | chunk | 6 | 8 | 75.0 | 20af3 | chunk | 7 | 28.9 | 22.2 | 6.4 | 1.1 | 10.9 | 20af3 | chunk | | | 1 |
| 21a7 | chunk | 6 | 6 | 100.0 | 21a7 | chunk | 5 | 40.0 | 27.8 | 11.1 | 0.4 | 4.5 | 21a7 | chunk | | 1 | |
| 21k3 | chunk | 1 | 1 | 100.0 | 21k3 | chunk | 2 | 28.2 | 24.7 | 7.0 | 0.3 | 2.9 | 21k3 | chunk | | 1 | |
| 21r3 | chunk | 4 | 5 | 80.0 | 21r3 | chunk | 1 | 36.6 | 15.2 | 5.6 | 0.2 | 1.8 | 21r3 | chunk | | | 1 |
| 23b2 | chunk | 4 | 6 | 66.7 | 23b2 | chunk | 5 | 48.0 | 45.0 | 21.6 | 0.2 | 2.3 | 23b2 | chunk | | | 1 |
| 23j1 | chunk | 4 | 4 | 100.0 | 23j1 | chunk | 1 | 27.5 | 14.0 | 3.9 | 0.3 | 2.6 | 23j1 | chunk | | 1 | |
| 27a1 | chunk | 4 | 4 | 100.0 | 27a1 | chunk | 7 | 38.6 | 37.2 | 14.4 | 0.5 | 4.9 | 27a1 | chunk | | | 1 |
| 28a2 | chunk | 2 | 2 | 100.0 | 28a2 | chunk | 4 | 70.8 | 48.2 | 34.1 | 0.1 | 1.2 | 28a2 | chunk | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28b1 | chunk | 3 | 3 | 100.0 | 28b1 | chunk | 4 | 49.0 | 42.9 | 21.0 | 0.2 | 1.9 | 28b1 | chunk | | | 1 |
| 28g | chunk | 3 | 8 | 37.5 | 28g | chunk | 1 | 25.8 | 15.1 | 3.9 | 0.3 | 2.6 | 28g | chunk | 1 | | |
| 28i | chunk | 5 | 5 | 100.0 | 28i | chunk | 6 | 30.7 | 15.0 | 4.6 | 1.3 | 13.0 | 28i | chunk | 1 | | |
| 29c1 | chunk | 0 | 8 | 0.0 | 29c1 | chunk | 0 | 29.4 | 35.2 | 10.3 | 0.0 | 0.0 | 29c1 | chunk | | | 1 |
| 29f | chunk | 1 | 1 | 100.0 | 29f | chunk | 1 | 29.0 | 14.5 | 4.2 | 0.2 | 2.4 | 29f | chunk | | 1 | |
| 30a1 | chunk | 1 | 8 | 12.5 | 30a1 | chunk | 0 | 32.6 | 17.0 | 5.5 | 0.0 | 0.0 | 30a1 | chunk | | 1 | |
| 30b2 | chunk | 7 | 10 | 70.0 | 30b2 | chunk | 2 | 38.0 | 33.0 | 12.5 | 0.2 | 1.6 | 30b2 | chunk | | 1 | |
| 30c2 | chunk | 5 | 5 | 100.0 | 30c2 | chunk | 9 | 41.1 | 41.1 | 16.9 | 0.5 | 5.3 | 30c2 | chunk | | 1 | |
| 30h11 | chunk | 3 | 3 | 100.0 | 30h11 | chunk | 8 | 25.0 | 20.0 | 5.0 | 1.6 | 16.0 | 30h11 | chunk | | | 1 |
| 30j4 | chunk | 5 | 7 | 71.4 | 30j4 | chunk | 1 | 29.5 | 23.3 | 6.9 | 0.1 | 1.5 | 30j4 | chunk | | 1 | |
| 32a6 | chunk | 6 | 8 | 75.0 | 32a6 | chunk | 5 | 28.4 | 19.4 | 5.5 | 0.9 | 9.1 | 32a6 | chunk | | | 1 |
| 33b13 | chunk | 7 | 7 | 100.0 | 33b13 | chunk | 9 | 27.6 | 19.4 | 5.4 | 1.7 | 16.8 | 33b13 | chunk | | 1 | |
| 33b14 | chunk | 6 | 6 | 100.0 | 33b14 | chunk | 7 | 19.5 | 16.7 | 3.3 | 2.1 | 21.5 | 33b14 | chunk | | 1 | |
| 34b1 | chunk | 2 | 7 | 28.6 | 34b1 | chunk | 2 | 22.4 | 15.8 | 3.5 | 0.6 | 5.7 | 34b1 | chunk | | 1 | |
| 38a2 | chunk | 5 | 9 | 55.6 | 38a2 | chunk | 18 | 48.5 | 18.2 | 8.8 | 2.0 | 20.4 | 38a2 | chunk | | 1 | |
| 38b4 | chunk | 4 | 6 | 66.7 | 38b4 | chunk | 2 | 33.6 | 18.5 | 6.2 | 0.3 | 3.2 | 38b4 | chunk | | | 1 |
| 38c2 | chunk | 1 | 3 | 33.3 | 38c2 | chunk | 5 | 26.0 | 14.8 | 3.8 | 1.3 | 13.0 | 38c2 | chunk | 1 | | |
| 39a2 | chunk | 4 | 4 | 100.0 | 39a2 | chunk | 4 | 23.8 | 22.4 | 5.3 | 0.8 | 7.5 | 39a2 | chunk | | 1 | |
| 39b2 | chunk | 3 | 8 | 37.5 | 39b2 | chunk | 2 | 20.1 | 12.2 | 2.5 | 0.8 | 8.2 | 39b2 | chunk | 1 | | |
| 39c2 | chunk | 3 | 5 | 60.0 | 39c2 | chunk | 0 | 20.4 | 13.3 | 2.7 | 0.0 | 0.0 | 39c2 | chunk | 1 | | |
| 40a3 | chunk | 4 | 4 | 100.0 | 40a3 | chunk | 6 | 19.0 | 18.6 | 3.5 | 1.7 | 17.0 | 40a3 | chunk | 1 | | |
| 40c2 | chunk | 5 | 5 | 100.0 | 40c2 | chunk | 11 | 25.1 | 21.5 | 5.4 | 2.0 | 20.4 | 40c2 | chunk | | 1 | |
| 40d2 | chunk | 5 | 5 | 100.0 | 40d2 | chunk | 13 | 17.7 | 17.0 | 3.0 | 4.3 | 43.2 | 40d2 | chunk | | 1 | |
| 41a3 | chunk | 0 | 7 | 0.0 | 41a3 | chunk | 0 | 23.7 | 11.7 | 2.8 | 0.0 | 0.0 | 41a3 | chunk | 1 | | |
| 41b1 | chunk | 6 | 7 | 85.7 | 41b1 | chunk | 3 | 25.7 | 11.4 | 2.9 | 1.0 | 10.2 | 41b1 | chunk | | 1 | |
| 42b4 | chunk | 4 | 6 | 66.7 | 42b4 | chunk | 4 | 21.5 | 14.9 | 3.2 | 1.2 | 12.5 | 42b4 | chunk | | 1 | |
| 42c4 | chunk | 0 | 9 | 0.0 | 42c4 | chunk | 3 | 26.2 | 10.5 | 2.8 | 1.1 | 10.9 | 42c4 | chunk | 1 | | |
| 43b3 | chunk | 0 | 3 | 0.0 | 43b3 | chunk | 1 | 22.8 | 15.7 | 3.6 | 0.3 | 2.8 | 43b3 | chunk | | 1 | |
| 43c3 | chunk | 5 | 5 | 100.0 | 43c3 | chunk | 7 | 27.8 | 20.0 | 5.6 | 1.3 | 12.6 | 43c3 | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44a2 | chunk | 7 | 7 | 100.0 | 44a2 | chunk | 5 | 29.3 | 25.2 | 7.4 | 0.7 | 6.8 | 44a2 | chunk | | 1 | |
| 44b4 | chunk | 2 | 2 | 100.0 | 44b4 | chunk | 3 | 23.8 | 12.6 | 3.0 | 1.0 | 10.0 | 44b4 | chunk | | 1 | |
| 44c3 | chunk | 1 | 2 | 50.0 | 44c3 | chunk | 1 | 23.0 | 18.5 | 4.3 | 0.2 | 2.4 | 44c3 | chunk | | | 1 |
| 45a3 | chunk | 7 | 7 | 100.0 | 45a3 | chunk | 4 | 27.8 | 19.0 | 5.3 | 0.8 | 7.6 | 45a3 | chunk | | 1 | |
| 45b1 | chunk | 3 | 7 | 42.9 | 45b1 | chunk | 4 | 21.0 | 21.0 | 4.4 | 0.9 | 9.1 | 45b1 | chunk | | 1 | |
| 47a | chunk | 9 | 12 | 75.0 | 47a | chunk | 11 | 57.7 | 37.6 | 21.7 | 0.5 | 5.1 | 47a | chunk | | 1 | |
| 47b | chunk | 2 | 8 | 25.0 | 47b | chunk | 3 | 22.6 | 17.0 | 3.8 | 0.8 | 7.8 | 47b | chunk | 1 | | |
| 47d | chunk | 6 | 8 | 75.0 | 47d | chunk | 3 | 34.5 | 27.1 | 9.3 | 0.3 | 3.2 | 47d | chunk | | 1 | |
| 47f | chunk | 2 | 4 | 50.0 | 47f | chunk | 8 | 26.1 | 16.3 | 4.3 | 1.9 | 18.8 | 47f | chunk | | 1 | |
| 47g | chunk | 5 | 14 | 35.7 | 47g | chunk | 2 | 46.3 | 36.5 | 16.9 | 0.1 | 1.2 | 47g | chunk | | 1 | |
| 47h | chunk | 3 | 4 | 75.0 | 47h | chunk | 3 | 26.6 | 26.0 | 6.9 | 0.4 | 4.3 | 47h | chunk | | 1 | |
| 47i | chunk | 4 | 9 | 44.4 | 47i | chunk | 4 | 29.2 | 16.3 | 4.8 | 0.8 | 8.4 | 47i | chunk | 1 | | |
| 47j | chunk | 3 | 6 | 50.0 | 47j | chunk | 4 | 41.0 | 31.5 | 12.9 | 0.3 | 3.1 | 47j | chunk | | 1 | |
| 50d | chunk | 5 | 12 | 41.7 | 50d | chunk | 1 | 42.8 | 22.3 | 9.5 | 0.1 | 1.0 | 50d | chunk | | 1 | |
| 50e | chunk | 6 | 7 | 85.7 | 50e | chunk | 14 | 36.4 | 33.4 | 12.2 | 1.2 | 11.5 | 50e | chunk | | | 1 |
| 50f | chunk | 4 | 6 | 66.7 | 50f | chunk | 2 | 35.0 | 18.5 | 6.5 | 0.3 | 3.1 | 50f | chunk | | 1 | |
| 50h | chunk | 6 | 6 | 100.0 | 50h | chunk | 1 | 26.8 | 15.1 | 4.0 | 0.2 | 2.5 | 50h | chunk | | 1 | |
| 51a | chunk | 3 | 5 | 60.0 | 51a | chunk | 2 | 32.8 | 23.6 | 7.7 | 0.3 | 2.6 | 51a | chunk | | | 1 |
| 51b | chunk | 2 | 2 | 100.0 | 51b | chunk | 11 | 33.0 | 17.3 | 5.7 | 1.9 | 19.3 | 51b | chunk | | 1 | |
| 51d | chunk | 5 | 8 | 62.5 | 51d | chunk | 2 | 29.8 | 28.6 | 8.5 | 0.2 | 2.3 | 51d | chunk | | 1 | |
| 51e | chunk | 4 | 4 | 100.0 | 51e | chunk | 4 | 27.3 | 15.5 | 4.2 | 0.9 | 9.5 | 51e | chunk | | | 1 |
| 51f | chunk | 0 | 8 | 0.0 | 51f | chunk | 2 | 20.8 | 9.1 | 1.9 | 1.1 | 10.6 | 51f | chunk | | 1 | |
| 51h | chunk | 5 | 5 | 100.0 | 51h | chunk | 11 | 32.8 | 25.7 | 8.4 | 1.3 | 13.0 | 51h | chunk | | 1 | |
| 51j | chunk | 2 | 4 | 50.0 | 51j | chunk | 0 | 27.5 | 22.7 | 6.2 | 0.0 | 0.0 | 51j | chunk | | 1 | |
| 52e | chunk | 7 | 9 | 77.8 | 52e | chunk | 1 | 37.7 | 23.1 | 8.7 | 0.1 | 1.1 | 52e | chunk | | 1 | |
| 53d | chunk | 3 | 4 | 75.0 | 53d | chunk | 1 | 40.0 | 18.1 | 7.2 | 0.1 | 1.4 | 53d | chunk | 1 | | |
| 54b2 | chunk | 11 | 13 | 84.6 | 54b2 | chunk | 6 | 27.7 | 22.0 | 6.1 | 1.0 | 9.8 | 54b2 | chunk | | 1 | |
| 55a,b2 | chunk | 1 | 5 | 20.0 | 55a,b2 | chunk | 4 | 22.8 | 20.9 | 4.8 | 0.8 | 8.4 | 55a,b2 | chunk | | 1 | |
| 56a2 | chunk | 7 | 8 | 87.5 | 56a2 | chunk | 9 | 50.6 | 27.8 | 14.1 | 0.6 | 6.4 | 56a2 | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 57a2 | chunk | 7 | 8 | 87.5 | 57a2 | chunk | 6 | 33.6 | 23.5 | 7.9 | 0.8 | 7.6 | 57a2 | chunk | | 1 | |
| 57b2 | chunk | 7 | 9 | 77.8 | 57b2 | chunk | 3 | 26.2 | 13.7 | 3.6 | 0.8 | 8.4 | 57b2 | chunk | | 1 | |
| 5bdug12 | chunk | 4 | 4 | 100.0 | 5bdug12 | chunk | 4 | 13.9 | 7.8 | 1.1 | 3.7 | 36.9 | 5bdug12 | chunk | | | 1 |
| 5bdug5 | chunk | 6 | 7 | 85.7 | 5bdug5 | chunk | 3 | 25.0 | 15.8 | 4.0 | 0.8 | 7.6 | 5bdug5 | chunk | | | 1 |
| 5csurf5 | chunk | 4 | 6 | 66.7 | 5csurf5 | chunk | 4 | 53.0 | 44.4 | 23.5 | 0.2 | 1.7 | 5csurf5 | chunk | | | 1 |
| 5csurf6 | chunk | 5 | 5 | 100.0 | 5csurf6 | chunk | 3 | 38.2 | 29.6 | 11.3 | 0.3 | 2.7 | 5csurf6 | chunk | | | 1 |
| 5kdug5 | chunk | 0 | 1 | 0.0 | 5kdug5 | chunk | 1 | 14.6 | 12.4 | 1.8 | 0.6 | 5.5 | 5kdug5 | chunk | | 1 | |
| 6h7 | chunk | 1 | 5 | 20.0 | 6h7 | chunk | 2 | 15.6 | 15.3 | 2.4 | 0.8 | 8.4 | 6h7 | chunk | | 1 | |
| 8p4 | chunk | 4 | 7 | 57.1 | 8p4 | chunk | 5 | 37.3 | 23.0 | 8.6 | 0.6 | 5.8 | 8p4 | chunk | | 1 | |
| 8r5 | chunk | 2 | 3 | 66.7 | 8r5 | chunk | 1 | 29.4 | 22.7 | 6.7 | 0.1 | 1.5 | 8r5 | chunk | | 1 | |
| 8t3 | chunk | 4 | 5 | 80.0 | 8t3 | chunk | 4 | 34.8 | 10.0 | 3.5 | 1.1 | 11.5 | 8t3 | chunk | | 1 | |
| 8w11 | chunk | 4 | 9 | 44.4 | 8w11 | chunk | 4 | 23.6 | 11.1 | 2.6 | 1.5 | 15.3 | 8w11 | chunk | | 1 | |
| 8w12 | chunk | 2 | 4 | 50.0 | 8w12 | chunk | 1 | 17.8 | 13.6 | 2.4 | 0.4 | 4.1 | 8w12 | chunk | | 1 | |
| 8x5 | chunk | 5 | 6 | 83.3 | 8x5 | chunk | 3 | 38.4 | 25.9 | 9.9 | 0.3 | 3.0 | 8x5 | chunk | | 1 | |
| 8x8 | chunk | 5 | 9 | 55.6 | 8x8 | chunk | 2 | 47.8 | 28.0 | 13.4 | 0.1 | 1.5 | 8x8 | chunk | | | 1 |
| 9c8 | chunk | 4 | 4 | 100.0 | 9c8 | chunk | 11 | 22.7 | 22.7 | 5.2 | 2.1 | 21.3 | 9c8 | chunk | | 1 | |
| 9c9 | chunk | 5 | 5 | 100.0 | 9c9 | chunk | 10 | 18.3 | 13.2 | 2.4 | 4.1 | 41.4 | 9c9 | chunk | | 1 | |
| 9d17 | chunk | 4 | 4 | 100.0 | 9d17 | chunk | 7 | 30.0 | 18.2 | 5.5 | 1.3 | 12.8 | 9d17 | chunk | | 1 | |
| 9g15 | chunk | 4 | 7 | 57.1 | 9g15 | chunk | 3 | 20.0 | 15.1 | 3.0 | 1.0 | 9.9 | 9g15 | chunk | | 1 | |
| 9h12 | chunk | 1 | 2 | 50.0 | 9h12 | chunk | 2 | 49.0 | 27.4 | 13.4 | 0.1 | 1.5 | 9h12 | chunk | | 1 | |
| 9i14 | chunk | 3 | 3 | 100.0 | 9i14 | chunk | 4 | 36.0 | 36.0 | 13.0 | 0.3 | 3.1 | 9i14 | chunk | | 1 | |
| 9L13 | chunk | 2 | 2 | 100.0 | 9L13 | chunk | 2 | 23.3 | 22.2 | 5.2 | 0.4 | 3.9 | 9L13 | chunk | | 1 | |
| 9L19 | chunk | 2 | 2 | 100.0 | 9L19 | chunk | 4 | 37.9 | 27.6 | 10.5 | 0.4 | 3.8 | 9L19 | chunk | | 1 | |
| 9m12 | chunk | 2 | 15 | 13.3 | 9m12 | chunk | 5 | 31.0 | 28.7 | 8.9 | 0.6 | 5.6 | 9m12 | chunk | | 1 | |
| 9n10 | chunk | 5 | 5 | 100.0 | 9n10 | chunk | 4 | 20.1 | 17.3 | 3.5 | 1.2 | 11.5 | 9n10 | chunk | | 1 | |
| 9n12 | chunk | 5 | 5 | 100.0 | 9n12 | chunk | 2 | 22.0 | 16.5 | 3.6 | 0.6 | 5.5 | 9n12 | chunk | | 1 | |
| 9p12 | chunk | 1 | 7 | 14.3 | 9p12 | chunk | 1 | 36.0 | 17.6 | 6.3 | 0.2 | 1.6 | 9p12 | chunk | 1 | | |
| 9q9 | chunk | 3 | 5 | 60.0 | 9q9 | chunk | 1 | 23.7 | 7.0 | 1.7 | 0.6 | 6.0 | 9q9 | chunk | | | 1 |
| 9r12 | chunk | 1 | 10 | 10.0 | 9r12 | chunk | 1 | 18.3 | 18.3 | 3.3 | 0.3 | 3.0 | 9r12 | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **a2** | chunk | 3 | 3 | 100.0 | **a2** | chunk | 0 | 23.3 | 16.0 | 3.7 | 0.0 | 0.0 | **a2** | chunk | | | 1 |
| s16e2 | chunk | 4 | 4 | 100.0 | s16e2 | chunk | 6 | 39.5 | 23.0 | 9.1 | 0.7 | 6.6 | s16e2 | chunk | | 1 | |
| S18e3 | chunk | 4 | 7 | 57.1 | S18e3 | chunk | 4 | 25.0 | 18.0 | 4.5 | 0.9 | 8.9 | S18e3 | chunk | | | 1 |
| S18e4 | chunk | 4 | 7 | 57.1 | S18e4 | chunk | 6 | 29.3 | 11.4 | 3.3 | 1.8 | 18.0 | S18e4 | chunk | | | 1 |
| S19e11 | chunk | 2 | 6 | 33.3 | S19e11 | chunk | 1 | 23.4 | 20 | 4.7 | 0.2 | 2.1 | S19e11 | chunk | 1 | | |
| s1e2 | chunk | 2 | 4 | 50.0 | s1e2 | chunk | 1 | 26.6 | 20.6 | 5.5 | 0.2 | 1.8 | s1e2 | chunk | | 1 | |
| S23e1 | chunk | 5 | 6 | 83.3 | S23e1 | chunk | 7 | 46.1 | 27.6 | 12.7 | 0.6 | 5.5 | S23e1 | chunk | 1 | | |
| S29e1 | chunk | 5 | 5 | 100.0 | S29e1 | chunk | 4 | 35.7 | 26.4 | 9.4 | 0.4 | 4.2 | S29e1 | chunk | | | 1 |
| S30e5 | chunk | 7 | 9 | 77.8 | S30e5 | chunk | 1 | 43.8 | 30.5 | 13.4 | 0.1 | 0.7 | S30e5 | chunk | | 1 | |
| S5edug2 | chunk | 2 | 4 | 50.0 | S5edug2 | chunk | 1 | 32.0 | 32.0 | 10.2 | 0.1 | 1.0 | S5edug2 | chunk | | 1 | |
| s9e7 | chunk | 3 | 3 | 100.0 | s9e7 | chunk | 5 | 24.2 | 10.8 | 2.6 | 1.9 | 19.1 | s9e7 | chunk | | 1 | |
| 9j5 | chunk | 7 | 9 | 77.8 | 9j5 | chunk | 6 | 21.8 | 20.0 | 4.4 | 1.4 | 13.8 | 9j5 | chunk | | 1 | |
| 9k7 | chunk | 0 | 8 | 0.0 | 9k7 | chunk | 4 | 25.3 | 16.2 | 4.1 | 1.0 | 9.8 | 9k7 | chunk | | 1 | |
| 9d8 | chunk | 2 | 3 | 66.7 | 9d8 | chunk | 10 | 46.6 | 19.6 | 9.1 | 1.1 | 10.9 | 9d8 | chunk | | 1 | |
| 15i1 | chunk | 4 | 4 | 100.0 | 15i1 | chunk | 2 | 15.7 | 10.2 | 1.6 | 1.2 | 12.5 | 15i1 | chunk | | 1 | |
| 15i10 | chunk | 1 | 1 | 100.0 | 15i10 | chunk | 10 | 44.8 | 31.0 | 13.9 | 0.7 | 7.2 | 15i10 | chunk | | 1 | |
| 15i2 | chunk | 2 | 2 | 100.0 | 15i2 | chunk | 2 | 15.3 | 13.3 | 2.0 | 1.0 | 9.8 | 15i2 | chunk | | 1 | |
| 15i6 | chunk | 1 | 1 | 100.0 | 15i6 | chunk | 2 | 25.0 | 19.7 | 4.9 | 0.4 | 4.1 | 15i6 | chunk | | 1 | |
| 15i7 | chunk | 3 | 3 | 100.0 | 15i7 | chunk | 5 | 52.8 | 27.4 | 14.5 | 0.3 | 3.5 | 15i7 | chunk | | 1 | |
| 15g4 | chunk | 4 | 4 | 100.0 | 15g4 | chunk | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g4 | chunk | | | 1 |
| 21a2 | chunk | 4 | 4 | 100.0 | 21a2 | chunk | 1 | 34.4 | 24.4 | 8.4 | 0.1 | 1.2 | 21a2 | chunk | | 1 | |
| 38c3 | core | 12 | 21 | 57.1 | 38c3 | core | 6 | 28.2 | 25.2 | 7.1 | 0.8 | 8.4 | 38c3 | core | 1 | | |
| 54b3 | core | 9 | 20 | 45.0 | 54b3 | core | 12 | 48.8 | 28.2 | 13.8 | 0.9 | 8.7 | 54b3 | core | | 1 | |
| 56a3 | core | 21 | 23 | 91.3 | 56a3 | core | 5 | 30.1 | 16.1 | 4.8 | 1.0 | 10.3 | 56a3 | core | | 1 | |
| 57a3 | core | 8 | 16 | 50.0 | 57a3 | core | 8 | 41.3 | 29.7 | 12.3 | 0.7 | 6.5 | 57a3 | core | | 1 | |
| 57b3 | core | 5 | 26 | 19.2 | 57b3 | core | 10 | 46.0 | 22.6 | 10.4 | 1.0 | 9.6 | 57b3 | core | | 1 | |
| 21k10 | core cent, Chopper | 9 | 26 | 34.6 | 21k10 | chopper/ cent core | 1 | 45.0 | 27.6 | 12.4 | 0.1 | 0.8 | 21k10 | chopper/ cent core | | 1 | |
| 9a2 | core, b/f | 15 | 19 | 78.9 | 9a2 | core, b/f | 10 | 55.3 | 35.6 | 19.7 | 0.5 | 5.1 | 9a2 | core, b/f | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9j16 | core, c | 8 | 12 | 66.7 | 9j16 | core, c | 12 | 32.0 | 32.0 | 10.2 | 1.2 | 11.7 | 9j16 | core, c | | 1 | |
| 19b4 | core, c | 14 | 23 | 60.9 | 19b4 | core, c | 16 | 48.0 | 45.0 | 21.6 | 0.7 | 7.4 | 19b4 | core, c | | 1 | |
| 9m15 | core, c | 3 | 23 | 13.0 | 9m15 | core, c | 7 | 29.5 | 25.8 | 7.6 | 0.9 | 9.2 | 9m15 | core, c | | 1 | |
| 9L16 | core, c/p | 24 | 37 | 64.9 | 9L16 | core, c/p | 1 | 43.8 | 35.7 | 15.6 | 0.1 | 0.6 | 9L16 | core, c/p | | 1 | |
| 14r3 | core, casual | 5 | 5 | 100.0 | 14r3 | core, casual | 3 | 48.5 | 31.0 | 15.0 | 0.2 | 2.0 | 14r3 | core, casual | | 1 | |
| 5bdug10 | core, casual | 4 | 8 | 50.0 | 5bdug10 | core, casual | 7 | 40.5 | 38.8 | 15.7 | 0.4 | 4.5 | 5bdug10 | core, casual | | | 1 |
| 8x7 | core, casual | 11 | 14 | 78.6 | 8x7 | core, casual | 4 | 40.0 | 30.0 | 12.0 | 0.3 | 3.3 | 8x7 | core, casual | | 1 | |
| 11b4 | core, cent | 9 | 19 | 47.4 | 11b4 | core, cent | 2 | 56.4 | 44.2 | 24.9 | 0.1 | 0.8 | 11b4 | core, cent | | 1 | |
| 14L2 | core, cent | 12 | 23 | 52.2 | 14L2 | core, cent | 19 | 68.0 | 51.0 | 34.7 | 0.5 | 5.5 | 14L2 | core, cent | | 1 | |
| 15k9 | core, cent | 4 | 10 | 40.0 | 15k9 | core, cent | 7 | 55.0 | 21.7 | 11.9 | 0.6 | 5.9 | 15k9 | core, cent | | 1 | |
| 16a10 | core, cent | 28 | 35 | 80.0 | 16a10 | core, cent | 6 | 53.6 | 38.2 | 20.5 | 0.3 | 2.9 | 16a10 | core, cent | | 1 | |
| 16c4 | core, cent | 23 | 49 | 46.9 | 16c4 | core, cent | 1 | 79 | 60 | 47.4 | 0.0 | 0.2 | 16c4 | core, cent | 1 | | |
| 18b8 | core, cent | 8 | 17 | 47.1 | 18b8 | core, cent | 22 | 51.0 | 27.2 | 13.9 | 1.6 | 15.9 | 18b8 | core, cent | | 1 | |
| 18d5 | core, cent | 10 | 20 | 50.0 | 18d5 | core, cent | 15 | 53.0 | 36.7 | 19.5 | 0.8 | 7.7 | 18d5 | core, cent | | | 1 |
| 19d10 | core, cent | 20 | 38 | 52.6 | 19d10 | core, cent | 9 | 63.0 | 38.4 | 24.2 | 0.4 | 3.7 | 19d10 | core, cent | | 1 | |
| 1b2 | core, cent | 7 | 30 | 23.3 | 1b2 | core, cent | 2 | 56.0 | 42.7 | 23.9 | 0.1 | 0.8 | 1b2 | core, cent | | 1 | |
| 1b4 | core, cent | 20 | 30 | 66.7 | 1b4 | core, cent | 3 | 52.7 | 34.8 | 18.3 | 0.2 | 1.6 | 1b4 | core, cent | 1 | | |
| 1f1 | core, cent | 7 | 23 | 30.4 | 1f1 | core, cent | 14 | 56.1 | 45.1 | 25.3 | 0.6 | 5.5 | 1f1 | core, cent | 1 | | |
| 1g4 | core, cent | 7 | 17 | 41.2 | 1g4 | core, cent | 11 | 39.5 | 35.6 | 14.1 | 0.8 | 7.8 | 1g4 | core, cent | | 1 | |
| 22b | core, cent | 14 | 21 | 66.7 | 22b | core, cent | 10 | 33.9 | 31.7 | 10.7 | 0.9 | 9.3 | 22b | core, cent | | 1 | |
| 30j5 | core, cent | 5 | 10 | 50.0 | 30j5 | core, cent | 1 | 27.0 | 23.0 | 6.2 | 0.2 | 1.6 | 30j5 | core, cent | | 1 | |
| 39a6 | core, cent | 14 | 16 | 87.5 | 39a6 | core, cent | 11 | 29.8 | 26.3 | 7.8 | 1.4 | 14.0 | 39a6 | core, cent | | 1 | |
| 39b6 | core, cent | 8 | 18 | 44.4 | 39b6 | core, cent | 3 | 24.7 | 21.8 | 5.4 | 0.6 | 5.6 | 39b6 | core, cent | | 1 | |
| 39c6 | core, cent | 7 | 13 | 53.8 | 39c6 | core, cent | 2 | 36.0 | 23.0 | 8.3 | 0.2 | 2.4 | 39c6 | core, cent | 1 | | |
| 40c4 | core, cent | 17 | 26 | 65.4 | 40c4 | core, cent | 12 | 22.3 | 21.7 | 4.8 | 2.5 | 24.8 | 40c4 | core, cent | | 1 | |
| 40d4 | core, cent | 19 | 19 | 100.0 | 40d4 | core, cent | 17 | 19.9 | 17.4 | 3.5 | 4.9 | 49.1 | 40d4 | core, cent | | 1 | |
| 41d1 | core, cent | 8 | 25 | 32.0 | 41d1 | core, cent | 2 | 30.2 | 23.5 | 7.1 | 0.3 | 2.8 | 41d1 | core, cent | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42b7 | core, cent | 15 | 16 | 93.8 | 42b7 | core, cent | 15 | 53.4 | 40.0 | 21.4 | 0.7 | 7.0 | 42b7 | core, cent | | 1 | |
| 42c7 | core, cent | 12 | 21 | 57.1 | 42c7 | core, cent | 13 | 45.7 | 39.5 | 18.1 | 0.7 | 7.2 | 42c7 | core, cent | 1 | | |
| 43b6 | core, cent | 8 | 11 | 72.7 | 43b6 | core, cent | 9 | 41.6 | 23.0 | 9.6 | 0.9 | 9.4 | 43b6 | core, cent | | 1 | |
| 43c6 | core, cent | 12 | 18 | 66.7 | 43c6 | core, cent | 10 | 38.2 | 31.5 | 12.0 | 0.8 | 8.3 | 43c6 | core, cent | | 1 | |
| 44c6 | core, cent | 11 | 21 | 52.4 | 44c6 | core, cent | 12 | 57.8 | 47.3 | 27.3 | 0.4 | 4.4 | 44c6 | core, cent | | | 1 |
| 45a6 | core, cent | 16 | 20 | 80.0 | 45a6 | core, cent | 11 | 60.4 | 53.5 | 32.3 | 0.3 | 3.4 | 45a6 | core, cent | | 1 | |
| 47d | core, cent | 16 | 19 | 84.2 | 47d | core, cent | 11 | 37.7 | 29.9 | 11.3 | 1.0 | 9.8 | 47d | core, cent | | 1 | |
| 47h | core, cent | 10 | 18 | 55.6 | 47h | core, cent | 1 | 43.2 | 41.7 | 18.0 | 0.1 | 0.6 | 47h | core, cent | | 1 | |
| 51d | core, cent | 11 | 23 | 47.8 | 51d | core, cent | 8 | 58.5 | 28.3 | 16.6 | 0.5 | 4.8 | 51d | core, cent | | 1 | |
| 51g | core, cent | 4 | 12 | 33.3 | 51g | core, cent | 8 | 47.5 | 39.4 | 18.7 | 0.4 | 4.3 | 51g | core, cent | | 1 | |
| 52b | core, cent | 16 | 19 | 84.2 | 52b | core, cent | 11 | 74.2 | 65.4 | 48.5 | 0.2 | 2.3 | 52b | core, cent | 1 | | |
| 52f | core, cent | 8 | 18 | 44.4 | 52f | core, cent | 6 | 53.2 | 44.1 | 23.5 | 0.3 | 2.6 | 52f | core, cent | | 1 | |
| 52h | core, cent | 4 | 18 | 22.2 | 52h | core, cent | 2 | 47.3 | 39.8 | 18.8 | 0.1 | 1.1 | 52h | core, cent | 1 | | |
| 53d | core, cent | 16 | 24 | 66.7 | 53d | core, cent | 3 | 32.1 | 31.2 | 10.0 | 0.3 | 3.0 | 53d | core, cent | 1 | | |
| 8w10 | core, cent | 12 | 28 | 42.9 | 8w10 | core, cent | 3 | 68.6 | 64.7 | 44.4 | 0.1 | 0.7 | 8w10 | core, cent | | 1 | |
| 9g13 | core, cent | 12 | 17 | 70.6 | 9g13 | core, cent | 4 | 25.2 | 17.8 | 4.5 | 0.9 | 8.9 | 9g13 | core, cent | | 1 | |
| S19e3 | core, cent | 8 | 25 | 32.0 | S19e3 | core, cent | 1 | 40 | 27.3 | 10.9 | 0.1 | 0.9 | S19e3 | core, cent | 1 | | |
| S30e10 | core, cent | 17 | 19 | 89.5 | S30e10 | core, cent | 1 | 45.5 | 45.5 | 20.7 | 0.0 | 0.5 | S30e10 | core, cent | | 1 | |
| 6h4 | core, cent | 10 | 27 | 37.0 | 6h4 | core, cent | 5 | 62.8 | 39.7 | 24.9 | 0.2 | 2.0 | 6h4 | core, cent | | 1 | |
| 55a,b3 | core, cent / cleaver | 20 | 27 | 74.1 | 55a,b3 | core, cent / cleaver | 14 | 36.4 | 33.4 | 12.2 | 1.2 | 11.5 | 55a,b3 | core, cent / cleaver | | 1 | |
| S18e5 | core, chunk | 6 | 11 | 54.5 | S18e5 | core, chunk | 17 | 42.3 | 35.5 | 15.0 | 1.1 | 11.3 | S18e5 | core, chunk | | | 1 |
| 11a9 | core, flat | 20 | 20 | 100.0 | 11a9 | core, flat | 8 | 38.6 | 19.2 | 7.4 | 1.1 | 10.8 | 11a9 | core, flat | | 1 | |
| 19d8 | core, flat | 5 | 15 | 33.3 | 19d8 | core, flat | 4 | 37.2 | 31.3 | 11.6 | 0.3 | 3.4 | 19d8 | core, flat | | 1 | |
| 25a | core, flat | 4 | 7 | 57.1 | 25a | core, flat | 1 | 22.4 | 21.1 | 4.7 | 0.2 | 2.1 | 25a | core, flat | | 1 | |
| 33b10 | core, flat | 23 | 26 | 88.5 | 33b10 | core, flat | 7 | 33.5 | 29.2 | 9.8 | 0.7 | 7.2 | 33b10 | core, flat | | 1 | |
| 33b9 | core, flat | 11 | 16 | 68.8 | 33b9 | core, flat | 5 | 31.8 | 28.0 | 8.9 | 0.6 | 5.6 | 33b9 | core, flat | | 1 | |
| 38b6 | core, flat | 9 | 10 | 90.0 | 38b6 | core, flat | 5 | 40.3 | 33.7 | 13.6 | 0.4 | 3.7 | 38b6 | core, flat | | | 1 |
| 45b4 | core, flat | 8 | 16 | 50.0 | 45b4 | core, flat | 15 | 34.7 | 26.5 | 9.2 | 1.6 | 16.3 | 45b4 | core, flat | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47b | core, flat | 15 | 21 | 71.4 | 47b | core, flat | 8 | 59.8 | 40.4 | 24.2 | 0.3 | 3.3 | 47b | core, flat | 1 | | |
| 53e | core, flat | 10 | 14 | 71.4 | 53e | core, flat | 2 | 36.8 | 29.0 | 10.7 | 0.2 | 1.9 | 53e | core, flat | | 1 | |
| 9p15 | core, flat | 1 | 15 | 6.7 | 9p15 | core, flat | 5 | 33.0 | 32.6 | 10.8 | 0.5 | 4.6 | 9p15 | core, flat | 1 | | |
| 47f | core, flat, prep | 7 | 16 | 43.8 | 47f | core, flat, prep | 10 | 49.7 | 31.2 | 15.5 | 0.6 | 6.4 | 47f | core, flat, prep | | 1 | |
| 14b3 | core, flat/p | 14 | 26 | 53.8 | 14b3 | core, flat/p | 2 | 57.0 | 49.7 | 28.3 | 0.1 | 0.7 | 14b3 | core, flat/p | | 1 | |
| 10h10 | core, p | 11 | 23 | 47.8 | 10h10 | core, p | 22 | 39.8 | 33.2 | 13.2 | 1.7 | 16.6 | 10h10 | core, p | | 1 | |
| 10h9 | core, p | 9 | 27 | 33.3 | 10h9 | core, p | 19 | 28.2 | 27.8 | 7.8 | 2.4 | 24.2 | 10h9 | core, p | | 1 | |
| 10m10 | core, p | 14 | 23 | 60.9 | 10m10 | core, p | 5 | 42.3 | 31.7 | 13.4 | 0.4 | 3.7 | 10m10 | core, p | | 1 | |
| 14k5 | core, p | 14 | 15 | 93.3 | 14k5 | core, p | 5 | 66.8 | 51.6 | 34.5 | 0.1 | 1.5 | 14k5 | core, p | | | 1 |
| 15b10 | core, p | 26 | 26 | 100.0 | 15b10 | core, p | 11 | 32.4 | 17.7 | 5.7 | 1.9 | 19.2 | 15b10 | core, p | | 1 | |
| 16f10 | core, p | 5 | 29 | 17.2 | 16f10 | core, p | 5 | 45.0 | 37.0 | 16.7 | 0.3 | 3.0 | 16f10 | core, p | | 1 | |
| 17a,b,c10 | core, p | 14 | 19 | 73.7 | 17a,b,c10 | core, p | 2 | 57.5 | 38.8 | 22.3 | 0.1 | 0.9 | 17a,b,c10 | core, p | | | 1 |
| 18a3 | core, p | 25 | 27 | 92.6 | 18a3 | core, p | 22 | 26.0 | 28.7 | 7.5 | 2.9 | 29.5 | 18a3 | core, p | | 1 | |
| 19a3 | core, p | 28 | 32 | 87.5 | 19a3 | core, p | 10 | 70.6 | 37.6 | 26.5 | 0.4 | 3.8 | 19a3 | core, p | | 1 | |
| 28h | core, p | 15 | 15 | 100.0 | 28h | core, p | 6 | 27.4 | 25.3 | 6.9 | 0.9 | 8.7 | 28h | core, p | | 1 | |
| 29c | core, p | 3 | 23 | 13.0 | 29c | core, p | 1 | 32.6 | 29.3 | 9.6 | 0.1 | 1.0 | 29c | core, p | | | 1 |
| 30a | core, p | 14 | 28 | 50.0 | 30a | core, p | 2 | 81.2 | 61.1 | 49.6 | 0.0 | 0.4 | 30a | core, p | | 1 | |
| 30g | core, p | 11 | 16 | 68.8 | 30g | core, p | 6 | 40.0 | 31.3 | 12.5 | 0.5 | 4.8 | 30g | core, p | | 1 | |
| 32a5 | core, p | 25 | 29 | 86.2 | 32a5 | core, p | 20 | 37.5 | 36.8 | 13.8 | 1.4 | 14.5 | 32a5 | core, p | | | 1 |
| 34a3 | core, p | 3 | 16 | 18.8 | 34a3 | core, p | 1 | 37.0 | 33.6 | 12.4 | 0.1 | 0.8 | 34a3 | core, p | | 1 | |
| 34b3 | core, p | 7 | 13 | 53.8 | 34b3 | core, p | 3 | 44.7 | 41.5 | 18.6 | 0.2 | 1.6 | 34b3 | core, p | | 1 | |
| 50c | core, p | 12 | 12 | 100.0 | 50c | core, p | 3 | 31.7 | 27.6 | 8.7 | 0.3 | 3.4 | 50c | core, p | | 1 | |
| 50d | core, p | 7 | 19 | 36.8 | 50d | core, p | 1 | 31.3 | 31.1 | 9.7 | 0.1 | 1.0 | 50d | core, p | | 1 | |
| 51e | core, p | 11 | 11 | 100.0 | 51e | core, p | 7 | 24.7 | 24.6 | 6.1 | 1.2 | 11.5 | 51e | core, p | | 1 | |
| 51i | core, p | 8 | 10 | 80.0 | 51i | core, p | 2 | 31.2 | 23.8 | 7.4 | 0.3 | 2.7 | 51i | core, p | | 1 | |
| 51j | core, p | 5 | 15 | 33.3 | 51j | core, p | 1 | 33.7 | 27.4 | 9.2 | 0.1 | 1.1 | 51j | core, p | | 1 | |
| 5csurf3 | core, p | 9 | 16 | 56.3 | 5csurf3 | core, p | 5 | 47.0 | 41.7 | 19.6 | 0.3 | 2.6 | 5csurf3 | core, p | | | 1 |
| 5csurf7 | core, p | 14 | 25 | 56.0 | 5csurf7 | core, p | 5 | 31.6 | 32.1 | 10.1 | 0.5 | 4.9 | 5csurf7 | core, p | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6h5 | core, p | 4 | 30 | 13.3 | 6h5 | core, p | 1 | 49.8 | 39.3 | 19.6 | 0.1 | 0.5 | 6h5 | core, p | | 1 | |
| 9c15 | core, p | 6 | 13 | 46.2 | 9c15 | core, p | 10 | 32.6 | 32.5 | 10.6 | 0.9 | 9.4 | 9c15 | core, p | | 1 | |
| 9d16 | core, p | 13 | 18 | 72.2 | 9d16 | core, p | 30 | 50.0 | 46.3 | 23.2 | 1.3 | 13.0 | 9d16 | core, p | | 1 | |
| 9f16 | core, p | 18 | 22 | 81.8 | 9f16 | core, p | 7 | 29.0 | 22.2 | 6.4 | 1.1 | 10.9 | 9f16 | core, p | | 1 | |
| 9h16 | core, p | 2 | 48 | 4.2 | 9h16 | core, p | 3 | 47.5 | 26.5 | 12.6 | 0.2 | 2.4 | 9h16 | core, p | 1 | | |
| 9i16 | core, p | 14 | 27 | 51.9 | 9i16 | core, p | 1 | 83.3 | 76.0 | 63.3 | 0.0 | 0.2 | 9i16 | core, p | | 1 | |
| S21e5 | core, p | 10 | 29 | 34.5 | S21e5 | core, p | 2 | 69.0 | 39.0 | 26.9 | 0.1 | 0.7 | S21e5 | core, p | | 1 | |
| 6g1 | core, p | 6 | 11 | 54.5 | 6g1 | core, p | 1 | 30.3 | 21.3 | 6.5 | 0.2 | 1.5 | 6g1 | core, p | | 1 | |
| 10s10 | core, pi | 4 | 15 | 26.7 | 10s10 | core, pi | 11 | 33.4 | 32.6 | 10.9 | 1.0 | 10.1 | 10s10 | core, pi | | 1 | |
| 10s9 | core, pi | 5 | 13 | 38.5 | 10s9 | core, pi | 9 | 22.0 | 19.8 | 4.4 | 2.1 | 20.7 | 10s9 | core, pi | | 1 | |
| 10v2 | core, pi | 12 | 28 | 42.9 | 10v2 | core, pi | 3 | 40.5 | 36.0 | 14.6 | 0.2 | 2.1 | 10v2 | core, pi | | 1 | |
| 11a8 | core, pi | 23 | 24 | 95.8 | 11a8 | core, pi | 10 | 22.7 | 20.7 | 4.7 | 2.1 | 21.3 | 11a8 | core, pi | | 1 | |
| 15b12 | core, pi | 9 | 9 | 100.0 | 15b12 | core, pi | 12 | 18.5 | 9.2 | 1.7 | 7.1 | 70.5 | 15b12 | core, pi | | 1 | |
| 15g | core, pi | 10 | 10 | 100.0 | 15g | core, pi | 9 | 31.9 | 17.3 | 5.5 | 1.6 | 16.3 | 15g | core, pi | | | 1 |
| 17a,b,c7 | core, pi | 12 | 16 | 75.0 | 17a,b,c7 | core, pi | 1 | 46.2 | 35.5 | 16.4 | 0.1 | 0.6 | 17a,b,c7 | core, pi | | | 1 |
| 18c11 | core, pi | 10 | 15 | 66.7 | 18c11 | core, pi | 24 | 49.0 | 35.8 | 17.5 | 1.4 | 13.7 | 18c11 | core, pi | | 1 | |
| 21a8 | core, pi | 9 | 12 | 75.0 | 21a8 | core, pi | 2 | 25.0 | 25.0 | 6.3 | 0.3 | 3.2 | 21a8 | core, pi | | 1 | |
| 22a | core, pi | 12 | 15 | 80.0 | 22a | core, pi | 3 | 76.5 | 61.1 | 46.7 | 0.1 | 0.6 | 22a | core, pi | | | 1 |
| 23b | core, pi | 8 | 14 | 57.1 | 23b | core, pi | 6 | 26.7 | 25.9 | 6.9 | 0.9 | 8.7 | 23b | core, pi | | 1 | |
| 23j | core, pi | 7 | 15 | 46.7 | 23j | core, pi | 4 | 39.4 | 18.2 | 7.2 | 0.6 | 5.6 | 23j | core, pi | | 1 | |
| 28b | core, pi | 9 | 10 | 90.0 | 28b | core, pi | 4 | 49.0 | 36.4 | 17.8 | 0.2 | 2.2 | 28b | core, pi | | 1 | |
| 28g | core, pi | 9 | 11 | 81.8 | 28g | core, pi | 6 | 35.4 | 30.2 | 10.7 | 0.6 | 5.6 | 28g | core, pi | | 1 | |
| 29b | core, pi | 7 | 14 | 50.0 | 29b | core, pi | 1 | 51.7 | 33.8 | 17.5 | 0.1 | 0.6 | 29b | core, pi | | | 1 |
| 30b | core, pi | 10 | 17 | 58.8 | 30b | core, pi | 5 | 56.6 | 38.7 | 21.9 | 0.2 | 2.3 | 30b | core, pi | | 1 | |
| 41a5 | core, pi | 6 | 17 | 35.3 | 41a5 | core, pi | 2 | 36.4 | 28.3 | 10.3 | 0.2 | 1.9 | 41a5 | core, pi | | 1 | |
| 44a5 | core, pi | 17 | 17 | 100.0 | 44a5 | core, pi | 6 | 24.3 | 20.9 | 5.1 | 1.2 | 11.8 | 44a5 | core, pi | | 1 | |
| 44b7 | core, pi | 11 | 12 | 91.7 | 44b7 | core, flat | 10 | 52.4 | 32.0 | 16.8 | 0.6 | 6.0 | 44b7 | core, pi | | 1 | |
| 47g | core, pi | 5 | 9 | 55.6 | 47g | core, pi | 3 | 44.0 | 32.1 | 14.1 | 0.2 | 2.1 | 47g | core, pi | 1 | | |
| 50e | core, pi | 7 | 12 | 58.3 | 50e | core, pi | 6 | 37.7 | 25.7 | 9.7 | 0.6 | 6.2 | 50e | core, pi | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50f | core, pi | 7 | 17 | 41.2 | 50f | core, pi | 4 | 43.8 | 32.2 | 14.1 | 0.3 | 2.8 | 50f | core, pi | | 1 | |
| 51f | core, pi | 2 | 8 | 25.0 | 51f | core, pi | 2 | 30.9 | 26.7 | 8.3 | 0.2 | 2.4 | 51f | core, pi | | 1 | |
| 52e | core, pi | 3 | 12 | 25.0 | 52e | core, pi | 4 | 44.0 | 35.5 | 15.6 | 0.3 | 2.6 | 52e | core, pi | | 1 | |
| 53c | core, pi | 9 | 15 | 60.0 | 53c | core, pi | 7 | 38.8 | 29.6 | 11.5 | 0.6 | 6.1 | 53c | core, pi | | 1 | |
| 8p5 | core, pi | 4 | 14 | 28.6 | 8p5 | core, pi | 3 | 42.2 | 25.4 | 10.7 | 0.3 | 2.8 | 8p5 | core, pi | | 1 | |
| 8u2 | core, pi | 15 | 18 | 83.3 | 8u2 | core, pi | 18 | 72.4 | 39.4 | 28.5 | 0.6 | 6.3 | 8u2 | core, pi | | 1 | |
| 8x10 | core, pi | 19 | 19 | 100.0 | 8x10 | core, pi | 4 | 68.0 | 39.2 | 26.7 | 0.2 | 1.5 | 8x10 | core, pi | | 1 | |
| 9c16 | core, pi | 10 | 10 | 100.0 | 9c16 | core, pi | 21 | 41.7 | 41.5 | 17.3 | 1.2 | 12.1 | 9c16 | core, pi | | 1 | |
| 9n15 | core, pi | 11 | 11 | 100.0 | 9n15 | core, pi | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n15 | core, pi | | 1 | |
| 9n16 | core, pi | 18 | 23 | 78.3 | 9n16 | core, pi | 2 | 46.0 | 24.0 | 11.0 | 0.2 | 1.8 | 9n16 | core, pi | | 1 | |
| 9p16 | core, pi | 5 | 15 | 33.3 | 9p16 | core, pi | 6 | 38.4 | 34.8 | 13.4 | 0.4 | 4.5 | 9p16 | core, pi | 1 | | |
| 9q12 | core, pi | 6 | 13 | 46.2 | 9q12 | core, pi | 1 | 42.0 | 37.3 | 15.7 | 0.1 | 0.6 | 9q12 | core, pi | | | 1 |
| s16e3 | core, pi | 11 | 17 | 64.7 | s16e3 | core, pi | 4 | 37.5 | 16.3 | 6.1 | 0.7 | 6.5 | s16e3 | core, pi | | 1 | |
| 19f/g3 | core, pi | 19 | 21 | 90.5 | 19f/g3 | core, pi | 9 | 36.7 | 35.5 | 13.0 | 0.7 | 6.9 | 19f/g3 | core, pi | | 1 | |
| 10L2 | core, pi | 16 | 20 | 80.0 | 10L2 | core, pi | 11 | 38.0 | 31.5 | 12.0 | 0.9 | 9.2 | 10L2 | core, pi | | 1 | |
| 10r3 | core, pi | 4 | 13 | 30.8 | 10r3 | core, pi | 2 | 40.0 | 29.5 | 11.8 | 0.2 | 1.7 | 10r3 | core, pi | | 1 | |
| 1i/j6 | denticulate | 3 | 12 | 25.0 | 1i/j1 | denticulate | 1 | 32.3 | 12.6 | 4.1 | 0.2 | 2.5 | 1i/j6 | denticulate | 1 | | |
| 10h6 | denticulate | 4 | 8 | 50.0 | 10h6 | denticulate | 12 | 40.7 | 26.0 | 10.6 | 1.1 | 11.3 | 10h6 | denticulate | | 1 | |
| 15a11 | denticulate | 6 | 23 | 26.1 | 15a11 | denticulate | 14 | 58.0 | 50.0 | 29.0 | 0.5 | 4.8 | 15a11 | denticulate | | 1 | |
| 15a8 | denticulate | 9 | 24 | 37.5 | 15a8 | denticulate | 4 | 65.6 | 58.2 | 38.2 | 0.1 | 1.0 | 15a8 | denticulate | | 1 | |
| 15b11 | denticulate | 6 | 8 | 75.0 | 15b11 | denticulate | 8 | 31.2 | 22.5 | 7.0 | 1.1 | 11.4 | 15b11 | denticulate | | 1 | |
| 15k11 | denticulate | 2 | 14 | 14.3 | 15k11 | denticulate | 3 | 21.6 | 20.9 | 4.5 | 0.7 | 6.6 | 15k11 | denticulate | | 1 | |
| 16a11 | denticulate | 2 | 10 | 20.0 | 16a11 | denticulate | 8 | 35.0 | 24.0 | 8.4 | 1.0 | 9.5 | 16a11 | denticulate | | 1 | |
| 16a12 | denticulate | 8 | 32 | 25.0 | 16a12 | denticulate | 19 | 56.4 | 49.6 | 28.0 | 0.7 | 6.8 | 16a12 | denticulate | 1 | | |
| 16d1 | denticulate | 1 | 6 | 16.7 | 16d1 | denticulate | 4 | 48.0 | 22.0 | 10.6 | 0.4 | 3.8 | 16d1 | denticulate | | 1 | |
| 16f12 | denticulate | 0 | 13 | 0.0 | 16f12 | denticulate | 2 | 32.3 | 21.5 | 6.9 | 0.3 | 2.9 | 16f12 | denticulate | | 1 | |
| 16f13 | denticulate | 0 | 15 | 0.0 | 16f13 | denticulate | 1 | 24.2 | 20.9 | 5.1 | 0.2 | 2.0 | 16f13 | denticulate | | 1 | |
| 17a,b,c11 | denticulate | 6 | 17 | 35.3 | 17a,b,c11 | denticulate | 5 | 40.0 | 32.7 | 13.1 | 0.4 | 3.8 | 17a,b,c11 | denticulate | | 1 | |
| 18b12 | denticulate | 2 | 11 | 18.2 | 18b12 | denticulate | 10 | 35.5 | 22.5 | 8.0 | 1.3 | 12.5 | 18b12 | denticulate | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18b13 | denticulate | 2 | 11 | 18.2 | 18b13 | denticulate | 13 | 43.8 | 14.8 | 6.5 | 2.0 | 20.1 | 18b13 | denticulate | | 1 | |
| 18d6 | denticulate | 6 | 14 | 42.9 | 18d6 | denticulate | 14 | 38.3 | 31.6 | 12.1 | 1.2 | 11.6 | 18d6 | denticulate | | | 1 |
| 19b2 | denticulate | 5 | 15 | 33.3 | 19b2 | denticulate | 10 | 45.0 | 44.3 | 19.9 | 0.5 | 5.0 | 19b2 | denticulate | | 1 | |
| 19c1 | denticulate | 4 | 17 | 23.5 | 19c1 | denticulate | 7 | 58 | 28.5 | 16.5 | 0.4 | 4.2 | 19c1 | denticulate | | 1 | |
| 19d11 | denticulate | 5 | 14 | 35.7 | 19d11 | denticulate | 8 | 24.1 | 14.1 | 3.4 | 2.4 | 23.5 | 19d11 | denticulate | | 1 | |
| 19f/g4 | denticulate | 4 | 10 | 40.0 | 19f/g4 | denticulate | 9 | 23.8 | 33.6 | 8.0 | 1.1 | 11.3 | 19f/g4 | denticulate | 1 | | |
| 1a5 | denticulate | 7 | 17 | 41.2 | 1a5 | denticulate | 8 | 33.4 | 31.3 | 10.5 | 0.8 | 7.7 | 1a5 | denticulate | | 1 | |
| 1b5 | denticulate | 4 | 18 | 22.2 | 1b5 | denticulate | 4 | 32.6 | 20.1 | 6.6 | 0.6 | 6.1 | 1b5 | denticulate | | 1 | |
| 1f2 | denticulate | 3 | 16 | 18.8 | 1f2 | denticulate | 1 | 28.8 | 20.7 | 6.0 | 0.2 | 1.7 | 1f2 | denticulate | 1 | | |
| 1g5 | denticulate | 4 | 14 | 28.6 | 1g5 | denticulate | 9 | 44.0 | 17.7 | 7.8 | 1.2 | 11.6 | 1g5 | denticulate | | 1 | |
| 22c2 | denticulate | 10 | 14 | 71.4 | 22c2 | denticulate | 1 | 29.7 | 14.0 | 4.2 | 0.2 | 2.4 | 22c2 | denticulate | | 1 | |
| 23b2 | denticulate | 1 | 21 | 4.8 | 23b2 | denticulate | 1 | 29.0 | 25.0 | 7.3 | 0.1 | 1.4 | 23b2 | denticulate | | 1 | |
| 23d2 | denticulate | 2 | 14 | 14.3 | 23d2 | denticulate | 2 | 42.6 | 28.4 | 12.1 | 0.2 | 1.7 | 23d2 | denticulate | | 1 | |
| 23j2 | denticulate | 4 | 15 | 26.7 | 23j2 | denticulate | 0 | 23.2 | 17.6 | 4.1 | 0.0 | 0.0 | 23j2 | denticulate | 1 | | |
| 25a | denticulate | 7 | 9 | 77.8 | 25a1 | denticulate | 6 | 25.4 | 25.4 | 6.5 | 0.9 | 9.3 | 25a1 | denticulate | | 1 | |
| 27a2 | denticulate | 8 | 10 | 80.0 | 27a2 | denticulate | 4 | 48.4 | 33.2 | 16.1 | 0.2 | 2.5 | 27a2 | denticulate | | | 1 |
| 28b2 | denticulate | 4 | 10 | 40.0 | 28b2 | denticulate | 2 | 32.0 | 22.4 | 7.2 | 0.3 | 2.8 | 28b2 | denticulate | | 1 | |
| 29c2 | denticulate | 2 | 14 | 14.3 | 29c2 | denticulate | 1 | 28.5 | 23.5 | 6.7 | 0.1 | 1.5 | 29c2 | denticulate | | | 1 |
| 30a2 | denticulate | 5 | 41 | 12.2 | 30a2 | denticulate | 3 | 58.4 | 34.1 | 19.9 | 0.2 | 1.5 | 30a2 | denticulate | | 1 | |
| 30b | denticulate | 1 | 12 | 8.3 | 30b2 | denticulate | 1 | 35.2 | 18.0 | 6.3 | 0.2 | 1.6 | 30b2 | denticulate | | 1 | |
| 30c2 | denticulate | 16 | 21 | 76.2 | 30c2 | denticulate | 17 | 84.0 | 42.4 | 35.6 | 0.5 | 4.8 | 30c2 | denticulate | | 1 | |
| 30i11 | denticulate | 5 | 10 | 50.0 | 30i11 | denticulate | 4 | 22.0 | 22.0 | 4.8 | 0.8 | 8.3 | 30i11 | denticulate | | 1 | |
| 34a2 | denticulate | 3 | 14 | 21.4 | 34a2 | denticulate | 3 | 30.0 | 20.0 | 6.0 | 0.5 | 5.0 | 34a2 | denticulate | | 1 | |
| 38b1 | denticulate | 5 | 10 | 50.0 | 38b1 | denticulate | 6 | 35.3 | 19.0 | 6.7 | 0.9 | 8.9 | 38b1 | denticulate | | | 1 |
| 38c6 | denticulate | 3 | 23 | 13.0 | 38c6 | denticulate | 2 | 31.4 | 15.2 | 4.8 | 0.4 | 4.2 | 38c6 | denticulate | 1 | | |
| 38d1 | denticulate | 5 | 10 | 50.0 | 38d1 | denticulate | 10 | 25.5 | 14.2 | 3.6 | 2.8 | 27.6 | 38d1 | denticulate | | | 1 |
| 39a1 | denticulate | 6 | 15 | 40.0 | 39a1 | denticulate | 10 | 33.3 | 14.0 | 4.7 | 2.1 | 21.5 | 39a1 | denticulate | 1 | | |
| 39b1 | denticulate | 2 | 9 | 22.2 | 39b1 | denticulate | 2 | 19.0 | 18.7 | 3.6 | 0.6 | 5.6 | 39b1 | denticulate | 1 | | |
| 39c1 | denticulate | 4 | 15 | 26.7 | 39c1 | denticulate | 3 | 25.5 | 17.4 | 4.4 | 0.7 | 6.8 | 39c1 | denticulate | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40a4 | denticulate | 3 | 19 | 15.8 | 40a4 | denticulate | 15 | 30.3 | 18.4 | 5.6 | 2.7 | 26.9 | 40a4 | denticulate | | 1 | |
| 40c3 | denticulate | 1 | 6 | 16.7 | 40c3 | denticulate | 8 | 31.7 | 21.7 | 6.9 | 1.2 | 11.6 | 40c3 | denticulate | | 1 | |
| 40d3 | denticulate | 12 | 15 | 80.0 | 40d3 | denticulate | 23 | 23.5 | 21.4 | 5.0 | 4.6 | 45.7 | 40d3 | denticulate | | 1 | |
| 41a4 | denticulate | 4 | 15 | 26.7 | 41a4 | denticulate | 5 | 45.7 | 29.3 | 13.4 | 0.4 | 3.7 | 41a4 | denticulate | | 1 | |
| 42b1 | denticulate | 9 | 20 | 45.0 | 42b1 | denticulate | 14 | 38.3 | 35.5 | 13.6 | 1.0 | 10.3 | 42b1 | denticulate | | 1 | |
| 42c1 | denticulate | 2 | 10 | 20.0 | 42c1 | denticulate | 6 | 39.0 | 17.7 | 6.9 | 0.9 | 8.7 | 42c1 | denticulate | 1 | | |
| 43b1 | denticulate | 6 | 22 | 27.3 | 43b1 | denticulate | 8 | 36.3 | 20.2 | 7.3 | 1.1 | 10.9 | 43b1 | denticulate | | 1 | |
| 43c1 | denticulate | 8 | 16 | 50.0 | 43c1 | denticulate | 7 | 37.1 | 24.2 | 9.0 | 0.8 | 7.8 | 43c1 | denticulate | 1 | | |
| 44b1 | denticulate | 4 | 11 | 36.4 | 44b1 | denticulate | 9 | 31.8 | 27.2 | 8.6 | 1.0 | 10.4 | 44b1 | denticulate | | 1 | |
| 45c1 | denticulate | 6 | 22 | 27.3 | 45c1 | denticulate | 10 | 50.7 | 32.0 | 16.2 | 0.6 | 6.2 | 45c1 | denticulate | | 1 | |
| 47a | denticulate | 7 | 17 | 41.2 | 47a | denticulate | 8 | 27.9 | 20.2 | 5.6 | 1.4 | 14.2 | 47a | denticulate | | 1 | |
| 47b | denticulate | 2 | 13 | 15.4 | 47b | denticulate | 6 | 40.0 | 26.8 | 10.7 | 0.6 | 5.6 | 47b | denticulate | 1 | | |
| 47f | denticulate | 5 | 13 | 38.5 | 47f | denticulate | 0 | 26.1 | 23.8 | 6.2 | 0.0 | 0.0 | 47f | denticulate | | 1 | |
| 47j | denticulate | 1 | 7 | 14.3 | 47j | denticulate | 2 | 29.8 | 17.5 | 5.2 | 0.4 | 3.8 | 47j | denticulate | | 1 | |
| 50d | denticulate | 9 | 25 | 36.0 | 50d | denticulate | 4 | 48.9 | 36.7 | 17.9 | 0.2 | 2.2 | 50d | denticulate | | 1 | |
| 51b | denticulate | 1 | 14 | 7.1 | 51b | denticulate | 3 | 29.3 | 17.7 | 5.2 | 0.6 | 5.8 | 51b | denticulate | | 1 | |
| 51g | denticulate | 2 | 20 | 10.0 | 51g | denticulate | 5 | 34.2 | 25.7 | 8.8 | 0.6 | 5.7 | 51g | denticulate | | 1 | |
| 52h | denticulate | 4 | 15 | 26.7 | 52h | denticulate | 2 | 30.2 | 20.7 | 6.3 | 0.3 | 3.2 | 52h | denticulate | 1 | | |
| 53d | denticulate | 4 | 23 | 17.4 | 53d | denticulate | 3 | 39.0 | 20.9 | 8.2 | 0.4 | 3.7 | 53d | denticulate | 1 | | |
| 55a,b6 | denticulate | 13 | 18 | 72.2 | 55a,b6 | denticulate | 7 | 27.6 | 24.8 | 6.8 | 1.0 | 10.2 | 55a,b6 | denticulate | | 1 | |
| 5csurf2 | denticulate | 4 | 11 | 36.4 | 5csurf2 | denticulate | 3 | 33.5 | 27.0 | 9.0 | 0.3 | 3.3 | 5csurf2 | denticulate | | | 1 |
| 8u3 | denticulate | 9 | 13 | 69.2 | 8u3 | denticulate | 13 | 61.0 | 31.6 | 19.3 | 0.7 | 6.7 | 8u3 | denticulate | | 1 | |
| 8w7 | denticulate | 7 | 27 | 25.9 | 8w7 | denticulate | 3 | 51.5 | 41.7 | 21.5 | 0.1 | 1.4 | 8w7 | denticulate | | 1 | |
| 9a11 | denticulate | 7 | 20 | 35.0 | 9a11 | denticulate | 14 | 32.2 | 19.4 | 6.2 | 2.2 | 22.4 | 9a11 | denticulate | | 1 | |
| 9b14 | denticulate | 0 | 6 | 0.0 | 9b14 | denticulate | 0 | 33.6 | 29.5 | 9.9 | 0.0 | 0.0 | 9b14 | denticulate | 1 | | |
| 9d14 | denticulate | 2 | 7 | 28.6 | 9d14 | denticulate | 20 | 47.0 | 34.4 | 16.2 | 1.2 | 12.4 | 9d14 | denticulate | | 1 | |
| 9i11 | denticulate | 3 | 12 | 25.0 | 9i11 | denticulate | 4 | 45.4 | 22.0 | 10.0 | 0.4 | 4.0 | 9i11 | denticulate | 1 | | |
| **a3** | denticulate | 10 | 15 | 66.7 | **a3** | denticulate | 3 | 48.6 | 36.0 | 17.5 | 0.2 | 1.7 | **a3** | denticulate | 1 | | |
| **a4** | denticulate | 12 | 13 | 92.3 | **a4** | denticulate | 1 | 31.2 | 27.5 | 8.6 | 0.1 | 1.2 | **a4** | denticulate | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S30e3 | denticulate | 1 | 12 | 8.3 | S30e3 | denticulate | 1 | 35.0 | 26.8 | 9.4 | 0.1 | 1.1 | S30e3 | denticulate | | 1 | |
| s41e1 | denticulate | 2 | 15 | 13.3 | s41e1 | denticulate | 6 | 36.5 | 20.0 | 7.3 | 0.8 | 8.2 | s41e1 | denticulate | | 1 | |
| s50e | denticulate | 11 | 11 | 100.0 | s50e | denticulate | 9 | 22.2 | 20.8 | 4.6 | 1.9 | 19.5 | s50e | denticulate | | 1 | |
| s53e | denticulate | 3 | 13 | 23.1 | s53e | denticulate | 1 | 30.3 | 16.6 | 5.0 | 0.2 | 2.0 | s53e | denticulate | | 1 | |
| s9e13 | denticulate | 7 | 9 | 77.8 | s9e13 | denticulate | 9 | 32.2 | 32.2 | 10.4 | 0.9 | 8.7 | s9e13 | denticulate | | 1 | |
| 21r1 | flake | 2 | 3 | 66.7 | 21r1 | bip flake | 1 | 22.6 | 7.8 | 1.8 | 0.6 | 5.7 | 21r1 | bip flake | | | 1 |
| 21r2 | flake | 3 | 3 | 100.0 | 21r2 | bip flake | 2 | 24.3 | 15.3 | 3.7 | 0.5 | 5.4 | 21r2 | bip flake | | | 1 |
| 21r5 | flake | 2 | 4 | 50.0 | 21r5 | bip flake | 4 | 43.7 | 19.6 | 8.6 | 0.5 | 4.7 | 21r5 | bip flake | | | 1 |
| 10h1 | flake | 3 | 8 | 37.5 | 10h1 | flake | 1 | 25.3 | 19.2 | 4.9 | 0.2 | 2.1 | 10h1 | flake | | 1 | |
| 10h4 | flake | 3 | 9 | 33.3 | 10h4 | flake | 9 | 28.0 | 21.3 | 6.0 | 1.5 | 15.1 | 10h4 | flake | | 1 | |
| 10L2 | flake | 2 | 2 | 100.0 | 10L2 | flake | 3 | 16.5 | 14.2 | 2.3 | 1.3 | 12.8 | 10L2 | flake | | 1 | |
| 10m6 | flake | 5 | 5 | 100.0 | 10m6 | flake | 2 | 27.0 | 22.5 | 6.1 | 0.3 | 3.3 | 10m6 | flake | | 1 | |
| 10m8 | flake | 6 | 6 | 100.0 | 10m8 | flake | 1 | 44.0 | 18.4 | 8.1 | 0.1 | 1.2 | 10m8 | flake | | 1 | |
| 10r4 | flake | 0 | 2 | 0.0 | 10r4 | flake | 1 | 22.3 | 14.7 | 3.3 | 0.3 | 3.1 | 10r4 | flake | | 1 | |
| 10s4 | flake | 5 | 6 | 83.3 | 10s4 | flake | 10 | 25.0 | 17.6 | 4.4 | 2.3 | 22.7 | 10s4 | flake | | 1 | |
| 10s8 | flake | 2 | 2 | 100.0 | 10s8 | flake | 14 | 41.7 | 29.0 | 12.1 | 1.2 | 11.6 | 10s8 | flake | | 1 | |
| 11a2 | flake | 1 | 1 | 100.0 | 11a2 | flake | 5 | 29.7 | 20.7 | 6.1 | 0.8 | 8.1 | 11a2 | flake | | 1 | |
| 11a6 | flake | 11 | 11 | 100.0 | 11a6 | flake | 11 | 24.0 | 15.2 | 3.6 | 3.0 | 30.2 | 11a6 | flake | | 1 | |
| 11b2 | flake | 7 | 13 | 53.8 | 11b2 | flake | 1 | 48.0 | 35.0 | 16.8 | 0.1 | 0.6 | 11b2 | flake | | | 1 |
| 13a3 | flake | 4 | 4 | 100.0 | 13a3 | flake | 2 | 31.8 | 28.0 | 8.9 | 0.2 | 2.2 | 13a3 | flake | | | 1 |
| 13a5 | flake | 1 | 1 | 100.0 | 13a5 | flake | 3 | 41.6 | 25.5 | 10.6 | 0.3 | 2.8 | 13a5 | flake | | | 1 |
| 14L1 | flake | 2 | 2 | 100.0 | 14L1 | flake | 4 | 57.0 | 28.2 | 16.1 | 0.2 | 2.5 | 14L1 | flake | | 1 | |
| 14m1 | flake | 3 | 4 | 75.0 | 14m1 | flake | 3 | 37.3 | 25.2 | 9.4 | 0.3 | 3.2 | 14m1 | flake | | 1 | |
| 15a5 | flake | 4 | 6 | 66.7 | 15a5 | flake | 3 | 48.0 | 44.0 | 21.1 | 0.1 | 1.4 | 15a5 | flake | | 1 | |
| 15a7 | flake | 6 | 17 | 35.3 | 15a7 | flake | 3 | 75.0 | 43.4 | 32.6 | 0.1 | 0.9 | 15a7 | flake | | 1 | |
| 15b6 | flake | 6 | 7 | 85.7 | 15b6 | flake | 7 | 31.0 | 22.6 | 7.0 | 1.0 | 10.0 | 15b6 | flake | | 1 | |
| 15b8 | flake | 3 | 3 | 100.0 | 15b8 | flake | 21 | 46.4 | 36.4 | 16.9 | 1.2 | 12.4 | 15b8 | flake | | 1 | |
| 15c2 | flake | 4 | 9 | 44.4 | 15c2 | flake | 20 | 54 | 32.5 | 17.6 | 1.1 | 11.4 | 15c2 | flake | | 1 | |
| 15d3 | flake | 7 | 8 | 87.5 | 15d3 | flake | 7 | 51.0 | 28.0 | 14.3 | 0.5 | 4.9 | 15d3 | flake | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15g2 | flake | 1 | 1 | 100.0 | 15g2 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g2 | flake | | | 1 |
| 15i3 | flake | 1 | 3 | 33.3 | 15i3 | flake | 4 | 22.6 | 8.0 | 1.8 | 2.2 | 22.1 | 15i3 | flake | | 1 | |
| 15i8 | flake | 4 | 4 | 100.0 | 15i8 | flake | 8 | 53.0 | 21.3 | 11.3 | 0.7 | 7.1 | 15i8 | flake | | 1 | |
| 15k2 | flake | 0 | 4 | 0.0 | 15k2 | flake | 2 | 16.0 | 14.5 | 2.3 | 0.9 | 8.6 | 15k2 | flake | | 1 | |
| 15k7 | flake | 2 | 8 | 25.0 | 15k7 | flake | 1 | 34.3 | 23.7 | 8.1 | 0.1 | 1.2 | 15k7 | flake | | 1 | |
| 16a3 | flake | 5 | 5 | 100.0 | 16a3 | flake | 2 | 22.6 | 21.8 | 4.9 | 0.4 | 4.1 | 16a3 | flake | | 1 | |
| 16a5 | flake | 5 | 6 | 83.3 | 16a5 | flake | 3 | 27.0 | 26.0 | 7.0 | 0.4 | 4.3 | 16a5 | flake | | 1 | |
| 16c2 | flake | 2 | 10 | 20.0 | 16c2 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 16c2 | flake | 1 | | |
| 16f5 | flake | 1 | 6 | 16.7 | 16f5 | flake | 2 | 33.0 | 21.3 | 7.0 | 0.3 | 2.8 | 16f5 | flake | | 1 | |
| 16f6 | flake | 0 | 5 | 0.0 | 16f6 | flake | 4 | 33.0 | 30.0 | 9.9 | 0.4 | 4.0 | 16f6 | flake | | 1 | |
| 16h1 | flake | 3 | 3 | 100.0 | 16h1 | flake | 4 | 23.4 | 17.0 | 4.0 | 1.0 | 10.1 | 16h1 | flake | 1 | | |
| 17a,b,c3 | flake | 0 | 1 | 0.0 | 17a,b,c3 | flake | 2 | 23.4 | 19.7 | 4.6 | 0.4 | 4.3 | 17a,b,c3 | flake | | | 1 |
| 17a,b,c4 | flake | 2 | 2 | 100.0 | 17a,b,c4 | flake | 2 | 39.4 | 18.2 | 7.2 | 0.3 | 2.8 | 17a,b,c4 | flake | | | 1 |
| 18a2 | flake | 5 | 8 | 62.5 | 18a2 | flake | 24 | 24.5 | 24.5 | 6.0 | 4.0 | 40.0 | 18a2 | flake | | 1 | |
| 18b6 | flake | 0 | 4 | 0.0 | 18b6 | flake | 20 | 48.5 | 32.3 | 15.7 | 1.3 | 12.8 | 18b6 | flake | | 1 | |
| 18b7 | flake | 5 | 6 | 83.3 | 18b7 | flake | 23 | 52.2 | 28.0 | 14.6 | 1.6 | 15.7 | 18b7 | flake | | 1 | |
| 18c14 | flake | 4 | 4 | 100.0 | 18c14 | flake | 25 | 44.8 | 21.2 | 9.5 | 2.6 | 26.3 | 18c14 | flake | | 1 | |
| 18c7 | flake | 3 | 3 | 100.0 | 18c7 | flake | 21 | 57.0 | 29.2 | 16.6 | 1.3 | 12.6 | 18c7 | flake | | 1 | |
| 18d4 | flake | 5 | 16 | 31.3 | 18d4 | flake | 11 | 39.0 | 30.0 | 11.7 | 0.9 | 9.4 | 18d4 | flake | | | 1 |
| 19a2 | flake | 8 | 11 | 72.7 | 19a2 | flake | 9 | 42 | 40 | 16.8 | 0.5 | 5.4 | 19a2 | flake | | 1 | |
| 19d7 | flake | 4 | 4 | 100.0 | 19d7 | flake | 12 | 42.3 | 36.3 | 15.4 | 0.8 | 7.8 | 19d7 | flake | | 1 | |
| 19d9 | flake | 2 | 2 | 100.0 | 19d9 | flake | 9 | 47.4 | 38.6 | 18.3 | 0.5 | 4.9 | 19d9 | flake | | 1 | |
| 19f/g2 | flake | 2 | 5 | 40.0 | 19f/g2 | flake | 5 | 37.0 | 34.4 | 12.7 | 0.4 | 3.9 | 19f/g2 | flake | | 1 | |
| 1a6 | flake | 6 | 10 | 60.0 | 1a6 | flake | 13 | 56.8 | 28.5 | 16.2 | 0.8 | 8.0 | 1a6 | flake | | 1 | |
| 1c3 | flake | 3 | 6 | 50.0 | 1c3 | flake | 3 | 36.0 | 23.6 | 8.5 | 0.4 | 3.5 | 1c3 | flake | 1 | | |
| 1g6 | flake | 3 | 6 | 50.0 | 1g6 | flake | 13 | 56.2 | 33.2 | 18.7 | 0.7 | 7.0 | 1g6 | flake | | 1 | |
| 1i/j1 | flake | 7 | 7 | 100.0 | 1i/j1 | flake | 2 | 46.7 | 28.0 | 13.1 | 0.2 | 1.5 | 1i/j1 | flake | 1 | | |
| 20af1 | flake | 3 | 5 | 60.0 | 20af1 | flake | 2 | 20.0 | 16.2 | 3.2 | 0.6 | 6.2 | 20af1 | flake | | 1 | |
| 21a10 | flake | 2 | 2 | 100.0 | 21a10 | flake | 15 | 61.3 | 59.0 | 36.2 | 0.4 | 4.1 | 21a10 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21k7 | flake | 1 | 1 | 100.0 | 21k7 | flake | 1 | 43.3 | 27.8 | 12.0 | 0.1 | 0.8 | 21k7 | flake | | 1 | |
| 22a1 | flake | 3 | 3 | 100.0 | 22a1 | flake | 3 | 60.0 | 35.0 | 21.0 | 0.1 | 1.4 | 22a1 | flake | | | 1 |
| 22b1 | flake | 1 | 2 | 50.0 | 22b1 | flake | 12 | 45.0 | 32.0 | 14.4 | 0.8 | 8.3 | 22b1 | flake | | 1 | |
| 23b1 | flake | 3 | 3 | 100.0 | 23b1 | flake | 2 | 50.0 | 40.0 | 20.0 | 0.1 | 1.0 | 23b1 | flake | | | 1 |
| 23j2 | flake | 3 | 4 | 75.0 | 23j2 | flake | 2 | 35.0 | 22.0 | 7.7 | 0.3 | 2.6 | 23j2 | flake | 1 | | |
| 23k1 | flake | 0 | 5 | 0.0 | 23k1 | flake | 1 | 15.0 | 12.0 | 1.8 | 0.6 | 5.6 | 23k1 | flake | 1 | | |
| 27a1 | flake | 2 | 2 | 100.0 | 27a1 | flake | 3 | 35.0 | 35.0 | 12.3 | 0.2 | 2.4 | 27a1 | flake | | | 1 |
| 28a1 | flake | 3 | 4 | 75.0 | 28a1 | flake | 1 | 38.0 | 20.0 | 7.6 | 0.1 | 1.3 | 28a1 | flake | | | 1 |
| 28b1 | flake | 4 | 4 | 100.0 | 28b1 | flake | 9 | 45.0 | 45.0 | 20.3 | 0.4 | 4.4 | 28b1 | flake | | 1 | |
| 29c1 | flake | 0 | 6 | 0.0 | 29c1 | flake | 1 | 20.0 | 15.0 | 3.0 | 0.3 | 3.3 | 29c1 | flake | | 1 | |
| 29d1 | flake | 1 | 1 | 100.0 | 29d1 | flake | 0 | 30.0 | 25.0 | 7.5 | 0.0 | 0.0 | 29d1 | flake | | 1 | |
| 30a2 | flake | 3 | 9 | 33.3 | 30a2 | flake | 1 | 73.0 | 50.0 | 36.5 | 0.0 | 0.3 | 30a2 | flake | 1 | | |
| 30b1 | flake | 1 | 9 | 11.1 | 30b1 | flake | 1 | 55.0 | 43.0 | 23.7 | 0.0 | 0.4 | 30b1 | flake | | 1 | |
| 30c1 | flake | 2 | 3 | 66.7 | 30c1 | flake | 2 | 30.0 | 30.0 | 9.0 | 0.2 | 2.2 | 30c1 | flake | | 1 | |
| 30d2 | flake | 5 | 10 | 50.0 | 30d2 | flake | 1 | 40.0 | 40.0 | 16.0 | 0.1 | 0.6 | 30d2 | flake | 1 | | |
| 30h2 | flake | 1 | 1 | 100.0 | 30h2 | flake | 1 | 45.3 | 34.6 | 15.7 | 0.1 | 0.6 | 30h2 | flake | | 1 | |
| 30i1 | flake | 3 | 5 | 60.0 | 30i1 | flake | 3 | 25.0 | 9.8 | 2.5 | 1.2 | 12.2 | 30i1 | flake | | 1 | |
| 32a1 | flake | 3 | 3 | 100.0 | 32a1 | flake | 4 | 21.5 | 18.5 | 4.0 | 1.0 | 10.1 | 32a1 | flake | | | 1 |
| 32a2 | flake | 1 | 1 | 100.0 | 32a2 | flake | 7 | 30.5 | 23.3 | 7.1 | 1.0 | 9.9 | 32a2 | flake | | | 1 |
| 33b4 | flake | 4 | 5 | 80.0 | 33b4 | flake | 5 | 38.3 | 9.4 | 3.6 | 1.4 | 13.9 | 33b4 | flake | | 1 | |
| 33b5 | flake | 1 | 1 | 100.0 | 33b5 | flake | 7 | 37.7 | 36.0 | 13.6 | 0.5 | 5.2 | 33b5 | flake | | 1 | |
| 38a3 | flake | 1 | 1 | 100.0 | 38a3 | flake | 24 | 22.7 | 23.8 | 5.4 | 4.4 | 44.4 | 38a3 | flake | | 1 | |
| 38b5 | flake | 1 | 2 | 50.0 | 38b5 | flake | 1 | 27.2 | 15.8 | 4.3 | 0.2 | 2.3 | 38b5 | flake | | | 1 |
| 38c1 | flake | 3 | 6 | 50.0 | 38c1 | flake | 1 | 20.3 | 15.2 | 3.1 | 0.3 | 3.2 | 38c1 | flake | 1 | | |
| 39a3 | flake | 4 | 4 | 100.0 | 39a3 | flake | 13 | 36.8 | 31.2 | 11.5 | 1.1 | 11.3 | 39a3 | flake | | 1 | |
| 39b3 | flake | 2 | 3 | 66.7 | 39b3 | flake | 1 | 36.0 | 17.2 | 6.2 | 0.2 | 1.6 | 39b3 | flake | 1 | | |
| 39c3 | flake | 0 | 2 | 0.0 | 39c3 | flake | 1 | 27.4 | 18.0 | 4.9 | 0.2 | 2.0 | 39c3 | flake | 1 | | |
| 40a2 | flake | 6 | 6 | 100.0 | 40a2 | flake | 12 | 27.5 | 16.4 | 4.5 | 2.7 | 26.6 | 40a2 | flake | | 1 | |
| 40c1 | flake | 3 | 5 | 60.0 | 40c1 | flake | 9 | 41.7 | 20.7 | 8.6 | 1.0 | 10.4 | 40c1 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40d1 | flake | 3 | 3 | 100.0 | 40d1 | flake | 18 | 25.2 | 24.0 | 6.0 | 3.0 | 29.8 | 40d1 | flake | | 1 | |
| 41a2 | flake | 3 | 6 | 50.0 | 41a2 | flake | 3 | 35.2 | 28.0 | 9.9 | 0.3 | 3.0 | 41a2 | flake | | 1 | |
| 41c2 | flake | 8 | 8 | 100.0 | 41c2 | flake | 0 | 34.7 | 21.4 | 7.4 | 0.0 | 0.0 | 41c2 | flake | 1 | | |
| 42b2 | flake | 5 | 7 | 71.4 | 42b2 | flake | 11 | 41.3 | 34.6 | 14.3 | 0.8 | 7.7 | 42b2 | flake | | 1 | |
| 42c2 | flake | 5 | 7 | 71.4 | 42c2 | flake | 1 | 39.3 | 18.1 | 7.1 | 0.1 | 1.4 | 42c2 | flake | 1 | | |
| 43b2 | flake | 3 | 3 | 100.0 | 43b2 | flake | 11 | 45.3 | 25.5 | 11.6 | 1.0 | 9.5 | 43b2 | flake | | 1 | |
| 43c2 | flake | 5 | 8 | 62.5 | 43c2 | flake | 5 | 32.3 | 22.1 | 7.1 | 0.7 | 7.0 | 43c2 | flake | | 1 | |
| 44a1 | flake | 6 | 6 | 100.0 | 44a1 | flake | 4 | 40.9 | 27.2 | 11.1 | 0.4 | 3.6 | 44a1 | flake | | 1 | |
| 44b2 | flake | 3 | 3 | 100.0 | 44b2 | flake | 4 | 27.7 | 26.0 | 7.2 | 0.6 | 5.6 | 44b2 | flake | | 1 | |
| 44c1 | flake | 2 | 5 | 40.0 | 44c1 | flake | 1 | 27.7 | 21.3 | 5.9 | 0.2 | 1.7 | 44c1 | flake | | | 1 |
| 45a1 | flake | 2 | 5 | 40.0 | 45a1 | flake | 5 | 44.0 | 26.0 | 11.4 | 0.4 | 4.4 | 45a1 | flake | | 1 | |
| 45c2 | flake | 3 | 5 | 60.0 | 45c2 | flake | 2 | 19.0 | 13.9 | 2.6 | 0.8 | 7.6 | 45c2 | flake | | 1 | |
| 47b | flake | 5 | 17 | 29.4 | 47b | flake | 12 | 65.6 | 32.0 | 21.0 | 0.6 | 5.7 | 47b | flake | | 1 | |
| 47d | flake | 1 | 4 | 25.0 | 47d | flake | 7 | 21.9 | 18.3 | 4.0 | 1.7 | 17.5 | 47d | flake | | 1 | |
| 47f | flake | 5 | 5 | 100.0 | 47f | flake | 22 | 39.6 | 19.7 | 7.8 | 2.8 | 28.2 | 47f | flake | | 1 | |
| 47g | flake | 2 | 4 | 50.0 | 47g | flake | 1 | 44.8 | 31.6 | 14.2 | 0.1 | 0.7 | 47g | flake | | 1 | |
| 47h | flake | 2 | 5 | 40.0 | 47h | flake | 0 | 34.2 | 23.7 | 8.1 | 0.0 | 0.0 | 47h | flake | | 1 | |
| 50c | flake | 4 | 8 | 50.0 | 50c | flake | 6 | 22.4 | 20.3 | 4.5 | 1.3 | 13.2 | 50c | flake | | | 1 |
| 50d | flake | 2 | 2 | 100.0 | 50d | flake | 3 | 32.0 | 30.1 | 9.6 | 0.3 | 3.1 | 50d | flake | | 1 | |
| 50e | flake | 4 | 4 | 100.0 | 50e | flake | 2 | 28.9 | 19.7 | 5.7 | 0.4 | 3.5 | 50e | flake | | 1 | |
| 50f | flake | 1 | 5 | 20.0 | 50f | flake | 1 | 17.4 | 12.5 | 2.2 | 0.5 | 4.6 | 50f | flake | | 1 | |
| 51b | flake | 3 | 5 | 60.0 | 51b | flake | 1 | 23.2 | 17.9 | 4.2 | 0.2 | 2.4 | 51b | flake | | 1 | |
| 51d | flake | 3 | 4 | 75.0 | 51d | flake | 1 | 27.9 | 14.6 | 4.1 | 0.2 | 2.5 | 51d | flake | | 1 | |
| 51e | flake | 1 | 1 | 100.0 | 51e | flake | 6 | 24.5 | 15.4 | 3.8 | 1.6 | 15.9 | 51e | flake | | 1 | |
| 51f | flake | 1 | 2 | 50.0 | 51f | flake | 1 | 20.7 | 15.3 | 3.2 | 0.3 | 3.2 | 51f | flake | | 1 | |
| 51g | flake | 2 | 5 | 40.0 | 51g | flake | 6 | 23.0 | 18.3 | 4.2 | 1.4 | 14.3 | 51g | flake | | 1 | |
| 51j | flake | 0 | 2 | 0.0 | 51j | flake | 3 | 23.0 | 17.9 | 4.1 | 0.7 | 7.3 | 51j | flake | | 1 | |
| 52a | flake | 2 | 3 | 66.7 | 52a | flake | 3 | 34.7 | 26.6 | 9.2 | 0.3 | 3.3 | 52a | flake | 1 | | |
| 52d | flake | 5 | 8 | 62.5 | 52d | flake | 4 | 35.1 | 33.6 | 11.8 | 0.3 | 3.4 | 52d | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 52e | flake | 2 | 5 | 40.0 | 52e | flake | 2 | 41.4 | 34.2 | 14.2 | 0.1 | 1.4 | 52e | flake | | 1 | |
| 52f | flake | 2 | 3 | 66.7 | 52f | flake | 6 | 31.8 | 25.1 | 8.0 | 0.8 | 7.5 | 52f | flake | | 1 | |
| 53d | flake | 0 | 7 | 0.0 | 53d | flake | 1 | 25.6 | 16.9 | 4.3 | 0.2 | 2.3 | 53d | flake | 1 | | |
| 54b1 | flake | 3 | 4 | 75.0 | 54b1 | flake | 4 | 32.2 | 23.3 | 7.5 | 0.5 | 5.3 | 54b1 | flake | | 1 | |
| 54i | flake | 4 | 4 | 100.0 | 54i | flake | 1 | 31.7 | 24.2 | 7.7 | 0.1 | 1.3 | 54i | flake | | | 1 |
| 55a,b1 | flake | 0 | 5 | 0.0 | 55a,b1 | flake | 6 | 30.2 | 24.7 | 7.5 | 0.8 | 8.0 | 55a,b1 | flake | | 1 | |
| 56a1 | flake | 4 | 4 | 100.0 | 56a1 | flake | 7 | 32.1 | 27.0 | 8.7 | 0.8 | 8.1 | 56a1 | flake | | 1 | |
| 57a1 | flake | 3 | 3 | 100.0 | 57a1 | flake | 8 | 25.0 | 22.2 | 5.6 | 1.4 | 14.4 | 57a1 | flake | | 1 | |
| 57b1 | flake | 1 | 4 | 25.0 | 57b1 | flake | 4 | 24.2 | 14.1 | 3.4 | 1.2 | 11.7 | 57b1 | flake | | 1 | |
| 5bdug4 | flake | 2 | 2 | 100.0 | 5bdug4 | flake | 3 | 25.2 | 11.1 | 2.8 | 1.1 | 10.7 | 5bdug4 | flake | | | 1 |
| 5bdug6 | flake | 3 | 3 | 100.0 | 5bdug6 | flake | 7 | 19.3 | 19.2 | 3.7 | 1.9 | 18.9 | 5bdug6 | flake | | | 1 |
| 5csurf4 | flake | 2 | 3 | 66.7 | 5csurf4 | flake | 3 | 65.3 | 28.0 | 18.3 | 0.2 | 1.6 | 5csurf4 | flake | | | 1 |
| 5kdug3 | flake | 2 | 2 | 100.0 | 5kdug3 | flake | 4 | 45.3 | 26.0 | 11.8 | 0.3 | 3.4 | 5kdug3 | flake | | 1 | |
| 6h1 | flake | 1 | 8 | 12.5 | 6h1 | flake | 0 | 40.5 | 30.0 | 12.2 | 0.0 | 0.0 | 6h1 | flake | | 1 | |
| 8p2 | flake | 2 | 3 | 66.7 | 8p2 | flake | 2 | 34.3 | 23.3 | 8.0 | 0.3 | 2.5 | 8p2 | flake | | 1 | |
| 8q2 | flake | 2 | 2 | 100.0 | 8q2 | flake | 5 | 28.7 | 28.6 | 8.2 | 0.6 | 6.1 | 8q2 | flake | | 1 | |
| 8s2 | flake | 5 | 11 | 45.5 | 8s2 | flake | 4 | 29.0 | 26.0 | 7.5 | 0.5 | 5.3 | 8s2 | flake | | 1 | |
| 8w3 | flake | 3 | 5 | 60.0 | 8w3 | flake | 4 | 45.4 | 23.0 | 10.4 | 0.4 | 3.8 | 8w3 | flake | | 1 | |
| 8w8 | flake | 1 | 8 | 12.5 | 8w8 | flake | 1 | 43.0 | 37.0 | 15.9 | 0.1 | 0.6 | 8w8 | flake | | 1 | |
| 8x1 | flake | 4 | 4 | 100.0 | 8x1 | flake | 2 | 18.0 | 11.7 | 2.1 | 0.9 | 9.5 | 8x1 | flake | | 1 | |
| 8x3 | flake | 4 | 4 | 100.0 | 8x3 | flake | 3 | 29.0 | 20.8 | 6.0 | 0.5 | 5.0 | 8x3 | flake | | 1 | |
| 9a6 | flake | 4 | 4 | 100.0 | 9a6 | flake | 10 | 53.2 | 44.0 | 23.4 | 0.4 | 4.3 | 9a6 | flake | | 1 | |
| 9b11 | flake | 4 | 5 | 80.0 | 9b11 | flake | 9 | 68.3 | 33.0 | 22.5 | 0.4 | 4.0 | 9b11 | flake | | 1 | |
| 9c12 | flake | 1 | 1 | 100.0 | 9c12 | flake | 24 | 46.0 | 31.0 | 14.3 | 1.7 | 16.8 | 9c12 | flake | | 1 | |
| 9c6 | flake | 5 | 5 | 100.0 | 9c6 | flake | 1 | 17.1 | 11.4 | 1.9 | 0.5 | 5.1 | 9c6 | flake | | 1 | |
| 9f10 | flake | 3 | 3 | 100.0 | 9f10 | flake | 20 | 51.0 | 35.0 | 17.9 | 1.1 | 11.2 | 9f10 | flake | | 1 | |
| 9h2 | flake | 0 | 3 | 0.0 | 9h2 | flake | 0 | 12.4 | 12.4 | 1.5 | 0.0 | 0.0 | 9h2 | flake | 1 | | |
| 9i7 | flake | 0 | 4 | 0.0 | 9i7 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i7 | flake | | 1 | |
| 9L12 | flake | 5 | 5 | 100.0 | 9L12 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L12 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9L14 | flake | 6 | 8 | 75.0 | 9L14 | flake | 1 | 47.5 | 29.0 | 13.8 | 0.1 | 0.7 | 9L14 | flake | | 1 | |
| 9L8 | flake | 5 | 6 | 83.3 | 9L8 | flake | 2 | 22.3 | 17.8 | 4.0 | 0.5 | 5.0 | 9L8 | flake | | 1 | |
| 9n4 | flake | 1 | 4 | 25.0 | 9n4 | flake | 2 | 19.4 | 16.2 | 3.1 | 0.6 | 6.4 | 9n4 | flake | | 1 | |
| 9n6 | flake | 1 | 6 | 16.7 | 9n6 | flake | 1 | 23.2 | 17.8 | 4.1 | 0.2 | 2.4 | 9n6 | flake | | 1 | |
| 9o14 | flake | 1 | 3 | 33.3 | 9o14 | flake | 4 | 41.8 | 21.7 | 9.1 | 0.4 | 4.4 | 9o14 | flake | | 1 | |
| 9q11 | flake | 5 | 7 | 71.4 | 9q11 | flake | 2 | 33.0 | 27.0 | 8.9 | 0.2 | 2.2 | 9q11 | flake | | | 1 |
| **a1** | flake | 1 | 1 | 100.0 | **a1** | flake | 2 | 40.0 | 30.0 | 12.0 | 0.2 | 1.7 | **a1** | flake | | 1 | |
| S18e1 | flake | 2 | 3 | 66.7 | S18e1 | flake | 4 | 18.4 | 9.0 | 1.7 | 2.4 | 24.2 | S18e1 | flake | | | 1 |
| s1e1 | flake | 0 | 5 | 0.0 | s1e1 | flake | 0 | 21.2 | 11.7 | 2.5 | 0.0 | 0.0 | s1e1 | flake | | 1 | |
| S21e2 | flake | 2 | 3 | 66.7 | S21e2 | flake | 2 | 46.7 | 28.0 | 13.1 | 0.2 | 1.5 | S21e2 | flake | | 1 | |
| S23e1 | flake | 2 | 3 | 66.7 | S23e1 | flake | 6 | 37.0 | 37.0 | 13.7 | 0.4 | 4.4 | S23e1 | flake | | 1 | |
| S30e8 | flake | 10 | 14 | 71.4 | S30e8 | flake | 1 | 45.6 | 42.2 | 19.2 | 0.1 | 0.5 | S30e8 | flake | | 1 | |
| S5edug1 | flake | 1 | 1 | 100.0 | S5edug1 | flake | 1 | 21.4 | 19.5 | 4.2 | 0.2 | 2.4 | S5edug1 | flake | | | 1 |
| s9e12 | flake | 6 | 6 | 100.0 | s9e12 | flake | 19 | 48.2 | 45.0 | 21.7 | 0.9 | 8.8 | s9e12 | flake | | 1 | |
| 18b2 | flake | 0 | 4 | 0.0 | 18b2 | flake | 11 | 22.7 | 16.2 | 3.7 | 3.0 | 29.9 | 18b2 | flake | | 1 | |
| 9r11 | flake | 1 | 12 | 8.3 | 9r11 | flake | 2 | 25.8 | 21.0 | 5.4 | 0.4 | 3.7 | 9r11 | flake | | 1 | |
| 16g3 | flake | 4 | 12 | 33.3 | 16g3 | flake | 6 | 43 | 29.3 | 12.6 | 0.5 | 4.8 | 16g3 | flake | | 1 | |
| 19d1 | flake | 0 | 5 | 0.0 | 19d1 | flake | 1 | 15.0 | 12.0 | 1.8 | 0.6 | 5.6 | 19d1 | flake | | 1 | |
| 19d2 | flake | 3 | 3 | 100.0 | 19d2 | flake | 5 | 19.0 | 16.4 | 3.1 | 1.6 | 16.0 | 19d2 | flake | | 1 | |
| 19d3 | flake | 2 | 6 | 33.3 | 19d3 | flake | 8 | 23.3 | 22.8 | 5.3 | 1.5 | 15.1 | 19d3 | flake | | 1 | |
| 18c1 | flake | 2 | 6 | 33.3 | 18c1 | flake | 6 | 17.7 | 9.2 | 1.6 | 3.7 | 36.8 | 18c1 | flake | | 1 | |
| 18c2 | flake | 1 | 7 | 14.3 | 18c2 | flake | 6 | 19.0 | 14.7 | 2.8 | 2.1 | 21.5 | 18c2 | flake | | 1 | |
| 18c4 | flake | 1 | 3 | 33.3 | 18c4 | flake | 3 | 26.7 | 13.5 | 3.6 | 0.8 | 8.3 | 18c4 | flake | | 1 | |
| 18c5 | flake | 2 | 2 | 100.0 | 18c5 | flake | 16 | 35.6 | 13.0 | 4.6 | 3.5 | 34.6 | 18c5 | flake | | 1 | |
| 9k8 | flake | 0 | 4 | 0.0 | 9k8 | flake | 2 | 24.8 | 22.3 | 5.5 | 0.4 | 3.6 | 9k8 | flake | | 1 | |
| 9m10 | flake | 4 | 9 | 44.4 | 9m10 | flake | 7 | 27.5 | 25.2 | 6.9 | 1.0 | 10.1 | 9m10 | flake | | 1 | |
| s16e1 | flake | 7 | 11 | 63.6 | s16e1 | flake | 6 | 47.2 | 22 | 10.4 | 0.6 | 5.8 | s16e1 | flake | | 1 | |
| 9L1 | flake | 0 | 7 | 0.0 | 9L1 | flake | 2 | 23.4 | 7.5 | 1.8 | 1.1 | 11.4 | 9L1 | flake | 1 | | |
| 9L2 | flake | 3 | 7 | 42.9 | 9L2 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L2 | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18d1 | flake | 0 | 8 | 0.0 | 18d1 | flake | 3 | 27.4 | 11.5 | 3.2 | 1.0 | 9.5 | 18d1 | flake | | | 1 |
| 9n1 | flake | 0 | 2 | 0.0 | 9n1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n1 | flake | | 1 | |
| 9n5 | flake | 4 | 4 | 100.0 | 9n5 | flake | 1 | 25.5 | 17.0 | 4.3 | 0.2 | 2.3 | 9n5 | flake | | 1 | |
| 15b1 | flake | 3 | 7 | 42.9 | 15b1 | flake | 6 | 21.0 | 12.0 | 2.5 | 2.4 | 23.8 | 15b1 | flake | | 1 | |
| 9i1 | flake | 0 | 2 | 0.0 | 9i1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i1 | flake | | 1 | |
| 15a1 | flake | 5 | 5 | 100.0 | 15a1 | flake | 2 | 22.8 | 17.0 | 3.9 | 0.5 | 5.2 | 15a1 | flake | | 1 | |
| 16f1 | flake | 0 | 3 | 0.0 | 16f1 | flake | 2 | 16.7 | 12.5 | 2.1 | 1.0 | 9.6 | 16f1 | flake | | 1 | |
| 16f3 | flake | 1 | 4 | 25.0 | 16f3 | flake | 6 | 25.4 | 19.0 | 4.8 | 1.2 | 12.4 | 16f3 | flake | | 1 | |
| 16a1 | flake | 0 | 4 | 0.0 | 16a1 | flake | 2 | 22.0 | 11.3 | 2.5 | 0.8 | 8.0 | 16a1 | flake | | 1 | |
| 9c2 | flake | 0 | 1 | 0.0 | 9c2 | flake | 0 | 28.4 | 10.1 | 2.9 | 0.0 | 0.0 | 9c2 | flake | | 1 | |
| 9c4 | flake | 2 | 2 | 100.0 | 9c4 | flake | 7 | 25.3 | 16.0 | 4.0 | 1.7 | 17.3 | 9c4 | flake | | 1 | |
| 9q3 | flake | 1 | 5 | 20.0 | 9q3 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9q3 | flake | | | 1 |
| 9q5 | flake | 2 | 3 | 66.7 | 9q5 | flake | 2 | 22.3 | 15.3 | 3.4 | 0.6 | 5.9 | 9q5 | flake | | | 1 |
| 15g1 | flake | 3 | 3 | 100.0 | 15g1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g1 | flake | | | 1 |
| S21e1 | flake | 1 | 2 | 50.0 | S21e1 | flake | 1 | 26.5 | 17.8 | 4.7 | 0.2 | 2.1 | S21e1 | flake | | | 1 |
| S21e4 | flake | 3 | 4 | 75.0 | S21e4 | flake | 4 | 55.5 | 39.4 | 21.9 | 0.2 | 1.8 | S21e4 | flake | | 1 | |
| 21a4 | flake | 1 | 1 | 100.0 | 21a4 | flake | 1 | 42.8 | 16.0 | 6.8 | 0.1 | 1.5 | 21a4 | flake | | 1 | |
| 21a6 | flake | 1 | 2 | 50.0 | 21a6 | flake | 4 | 45.6 | 34.8 | 15.9 | 0.3 | 2.5 | 21a6 | flake | | 1 | |
| 21k2 | flake | 1 | 3 | 33.3 | 21k2 | flake | 0 | 31.2 | 17.0 | 5.3 | 0.0 | 0.0 | 21k2 | flake | | 1 | |
| 21k4 | flake | 4 | 6 | 66.7 | 21k4 | flake | 1 | 29.7 | 27.5 | 8.2 | 0.1 | 1.2 | 21k4 | flake | | 1 | |
| 21k5 | flake | 4 | 8 | 50.0 | 21k5 | flake | 1 | 38.7 | 22.5 | 8.7 | 0.1 | 1.1 | 21k5 | flake | | 1 | |
| 21k6 | flake | 3 | 3 | 100.0 | 21k6 | flake | 1 | 36.4 | 24.5 | 8.9 | 0.1 | 1.1 | 21k6 | flake | | 1 | |
| 5bdug1 | flake | 3 | 4 | 75.0 | 5bdug1 | flake | 0 | 22.0 | 8.3 | 1.8 | 0.0 | 0.0 | 5bdug1 | flake | | | 1 |
| 5bdug2 | flake | 1 | 1 | 100.0 | 5bdug2 | flake | 6 | 17.3 | 13.7 | 2.4 | 2.5 | 25.3 | 5bdug2 | flake | | | 1 |
| 8q1 | flake | 5 | 6 | 83.3 | 8q1 | flake | 3 | 26.0 | 18.0 | 4.7 | 0.6 | 6.4 | 8q1 | flake | | 1 | |
| 33b1 | flake | 5 | 6 | 83.3 | 33b1 | flake | 3 | 20.0 | 16.4 | 3.3 | 0.9 | 9.1 | 33b1 | flake | | 1 | |
| 33b3 | flake | 4 | 4 | 100.0 | 33b3 | flake | 5 | 30.0 | 27.2 | 8.2 | 0.6 | 6.1 | 33b3 | flake | | 1 | |
| 33b7 | flake | 3 | 4 | 75.0 | 33b7 | flake | 7 | 28.8 | 24.6 | 7.1 | 1.0 | 9.9 | 33b7 | flake | | 1 | |
| 11a3 | flake | 3 | 3 | 100.0 | 11a3 | flake | 4 | 31.0 | 27.7 | 8.6 | 0.5 | 4.7 | 11a3 | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11b1 | flake | 8 | 11 | 72.7 | 11b1 | flake | 3 | 41.8 | 36.6 | 15.3 | 0.2 | 2.0 | 11b1 | flake | | | 1 |
| 8r2 | flake | 3 | 5 | 60.0 | 8r2 | flake | 1 | 29.2 | 19.0 | 5.5 | 0.2 | 1.8 | 8r2 | flake | | 1 | |
| 10h3 | flake | 3 | 8 | 37.5 | 10h3 | flake | 7 | 25.8 | 23.6 | 6.1 | 1.1 | 11.5 | 10h3 | flake | | 1 | |
| 34a1 | flake | 2 | 2 | 100.0 | 34a1 | flake | 7 | 31.8 | 17.0 | 5.4 | 1.3 | 12.9 | 34a1 | flake | | 1 | |
| 10s1 | flake | 2 | 2 | 100.0 | 10s1 | flake | 1 | 18.0 | 16.6 | 3.0 | 0.3 | 3.3 | 10s1 | flake | | 1 | |
| 8p3 | flake | 1 | 2 | 50.0 | 8p3 | flake | 7 | 38.7 | 35.6 | 13.8 | 0.5 | 5.1 | 8p3 | flake | | 1 | |
| 10m1 | flake | 1 | 5 | 20.0 | 10m1 | flake | 0 | 17.7 | 13.8 | 2.4 | 0.0 | 0.0 | 10m1 | flake | | 1 | |
| 10m2 | flake | 1 | 5 | 20.0 | 10m2 | flake | 1 | 24.7 | 10.5 | 2.6 | 0.4 | 3.9 | 10m2 | flake | | 1 | |
| 8x2 | flake | 4 | 4 | 100.0 | 8x2 | flake | 1 | 19.8 | 10.7 | 2.1 | 0.5 | 4.7 | 8x2 | flake | | 1 | |
| 8x6 | flake | 5 | 5 | 100.0 | 8x6 | flake | 2 | 40.6 | 31.0 | 12.6 | 0.2 | 1.6 | 8x6 | flake | | | 1 |
| 14r2 | flake | 3 | 4 | 75.0 | 14r2 | flake | 4 | 29.0 | 21.8 | 6.3 | 0.6 | 6.3 | 14r2 | flake | | | 1 |
| 14k1 | flake | 5 | 5 | 100.0 | 14k1 | flake | 4 | 25.7 | 21.0 | 5.4 | 0.7 | 7.4 | 14k1 | flake | | | 1 |
| 14k2 | flake | 3 | 3 | 100.0 | 14k2 | flake | 4 | 26.0 | 19.8 | 5.1 | 0.8 | 7.8 | 14k2 | flake | | | 1 |
| 10h2 | retouch | 5 | 12 | 41.7 | 10h2 | retouch | 5 | 31.0 | 19.6 | 6.1 | 0.8 | 8.2 | 10h2 | retouch | | 1 | |
| 10h5 | retouch | 5 | 14 | 35.7 | 10h5 | retouch | 12 | 34.3 | 26.3 | 9.0 | 1.3 | 13.3 | 10h5 | retouch | | 1 | |
| 10L1 | retouch | 2 | 7 | 28.6 | 10L1 | retouch | 5 | 27.4 | 24.0 | 6.6 | 0.8 | 7.6 | 10L1 | retouch | | 1 | |
| 10m3 | retouch | 4 | 6 | 66.7 | 10m3 | retouch | 0 | 29.5 | 15.0 | 4.4 | 0.0 | 0.0 | 10m3 | retouch | | 1 | |
| 10m9 | retouch | 6 | 10 | 60.0 | 10m9 | retouch | 4 | 43.2 | 27.6 | 11.9 | 0.3 | 3.4 | 10m9 | retouch | | 1 | |
| 10r5 | retouch | 3 | 16 | 18.8 | 10r5 | retouch | 5 | 23.3 | 19.4 | 4.5 | 1.1 | 11.1 | 10r5 | retouch | | 1 | |
| 10s2 | retouch | 1 | 2 | 50.0 | 10s2 | retouch | 9 | 25.8 | 19.5 | 5.0 | 1.8 | 17.9 | 10s2 | retouch | | 1 | |
| 10s3 | retouch | 1 | 8 | 12.5 | 10s3 | retouch | 6 | 23.0 | 22.4 | 5.2 | 1.2 | 11.6 | 10s3 | retouch | | 1 | |
| 11a1 | retouch | 10 | 20 | 50.0 | 11a1 | retouch | 4 | 26.2 | 18.0 | 4.7 | 0.8 | 8.5 | 11a1 | retouch | | 1 | |
| 11a12 | retouch | 9 | 12 | 75.0 | 11a12 | retouch | 10 | 32.5 | 23.8 | 7.7 | 1.3 | 12.9 | 11a12 | retouch | | 1 | |
| 11b5 | retouch | 1 | 13 | 7.7 | 11b5 | retouch | 4 | 37.0 | 21.8 | 8.1 | 0.5 | 5.0 | 11b5 | retouch | | | 1 |
| 13a1 | retouch | 3 | 6 | 50.0 | 13a1 | retouch | 3 | 32.0 | 18.0 | 5.8 | 0.5 | 5.2 | 13a1 | retouch | | | 1 |
| 14b4 | retouch | 0 | 19 | 0.0 | 14b4 | retouch | 0 | 32.9 | 19.4 | 6.4 | 0.0 | 0.0 | 14b4 | retouch | | 1 | |
| 14k3 | retouch | 3 | 10 | 30.0 | 14k3 | retouch | 8 | 35.3 | 23.6 | 8.3 | 1.0 | 9.6 | 14k3 | retouch | | | 1 |
| 15a2 | retouch | 0 | 16 | 0.0 | 15a2 | retouch | 3 | 28.8 | 25.0 | 7.2 | 0.4 | 4.2 | 15a2 | retouch | | 1 | |
| 15a4 | retouch | 0 | 12 | 0.0 | 15a4 | retouch | 2 | 56.7 | 27.0 | 15.3 | 0.1 | 1.3 | 15a4 | retouch | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15b3 | retouch | 11 | 15 | 73.3 | 15b3 | retouch | 6 | 29.0 | 20.5 | 5.9 | 1.0 | 10.1 | 15b3 | retouch | | 1 | |
| 15b5 | retouch | 8 | 28 | 28.6 | 15b5 | retouch | 10 | 32.3 | 31.5 | 10.2 | 1.0 | 9.8 | 15b5 | retouch | | 1 | |
| 15c1 | retouch | 12 | 23 | 52.2 | 15c1 | retouch | 14 | 46.0 | 35.7 | 16.4 | 0.9 | 8.5 | 15c1 | retouch | | 1 | |
| 15g14 | retouch | 14 | 18 | 77.8 | 15g14 | retouch | 8 | 27.9 | 21.3 | 5.9 | 1.3 | 13.5 | 15g14 | retouch | | | 1 |
| 15i11 | retouch | 5 | 13 | 38.5 | 15i11 | retouch | 12 | 43.0 | 22.5 | 9.7 | 1.2 | 12.4 | 15i11 | retouch | | 1 | |
| 15i12 | retouch | 5 | 8 | 62.5 | 15i12 | retouch | 21 | 42.7 | 30.5 | 13.0 | 1.6 | 16.1 | 15i12 | retouch | | 1 | |
| 15k3 | retouch | 0 | 13 | 0.0 | 15k3 | retouch | 3 | 20.8 | 16.0 | 3.3 | 0.9 | 9.0 | 15k3 | retouch | | 1 | |
| 15k4 | retouch | 2 | 12 | 16.7 | 15k4 | retouch | 0 | 25.5 | 16.3 | 4.2 | 0.0 | 0.0 | 15k4 | retouch | | 1 | |
| 16a4 | retouch | 0 | 10 | 0.0 | 16a4 | retouch | 3 | 27.6 | 20.0 | 5.5 | 0.5 | 5.4 | 16a4 | retouch | | 1 | |
| 16a6 | retouch | 4 | 6 | 66.7 | 16a6 | retouch | 5 | 45.5 | 17.0 | 7.7 | 0.6 | 6.5 | 16a6 | retouch | | 1 | |
| 16c3 | retouch | 4 | 22 | 18.2 | 16c3 | retouch | 10 | 66.0 | 46.0 | 30.4 | 0.3 | 3.3 | 16c3 | retouch | 1 | | |
| 16d3 | retouch | 24 | 30 | 80.0 | 16d3 | retouch | 6 | 55.0 | 18.0 | 9.9 | 0.6 | 6.1 | 16d3 | retouch | | 1 | |
| 16f4 | retouch | 0 | 16 | 0.0 | 16f4 | retouch | 5 | 37.0 | 14.7 | 5.4 | 0.9 | 9.2 | 16f4 | retouch | | 1 | |
| 16f8 | retouch | 2 | 16 | 12.5 | 16f8 | retouch | 8 | 46.3 | 32.0 | 14.8 | 0.5 | 5.4 | 16f8 | retouch | | 1 | |
| 17a,b,c1 | retouch | 3 | 15 | 20.0 | 17a,b,c1 | retouch | 1 | 18.0 | 15.6 | 2.8 | 0.4 | 3.6 | 17a,b,c1 | retouch | | | 1 |
| 17a,b,c6 | retouch | 5 | 23 | 21.7 | 17a,b,c6 | retouch | 3 | 43.7 | 22.8 | 10.0 | 0.3 | 3.0 | 17a,b,c6 | retouch | | 1 | |
| 18b3 | retouch | 0 | 18 | 0.0 | 18b3 | retouch | 14 | 28.0 | 19.2 | 5.4 | 2.6 | 26.0 | 18b3 | retouch | | 1 | |
| 18b4 | retouch | 0 | 15 | 0.0 | 18b4 | retouch | 14 | 35.8 | 17.8 | 6.4 | 2.2 | 22.0 | 18b4 | retouch | | 1 | |
| 18c13 | retouch | 7 | 16 | 43.8 | 18c13 | retouch | 12 | 30.0 | 14.3 | 4.3 | 2.8 | 28.0 | 18c13 | retouch | | 1 | |
| 18c8 | retouch | 3 | 14 | 21.4 | 18c8 | retouch | 11 | 44.5 | 18.0 | 8.0 | 1.4 | 13.7 | 18c8 | retouch | | 1 | |
| 18d2 | retouch | 0 | 13 | 0.0 | 18d2 | retouch | 10 | 33.6 | 24.0 | 8.1 | 1.2 | 12.4 | 18d2 | retouch | | | 1 |
| 19c2 | retouch | 6 | 21 | 28.6 | 19c2 | retouch | 6 | 44.4 | 33.0 | 14.7 | 0.4 | 4.1 | 19c2 | retouch | | 1 | |
| 19d12 | retouch | 4 | 19 | 21.1 | 19d12 | retouch | 4 | 37.2 | 24.4 | 9.1 | 0.4 | 4.4 | 19d12 | retouch | | 1 | |
| 19d6 | retouch | 3 | 14 | 21.4 | 19d6 | retouch | 15 | 43.0 | 25.0 | 10.8 | 1.4 | 14.0 | 19d6 | retouch | | 1 | |
| 19f/g1 | retouch | 4 | 19 | 21.1 | 19f/g1 | retouch | 6 | 20 | 20 | 4.0 | 1.5 | 15.0 | 19f/g1 | retouch | 1 | | |
| 1a1 | retouch | 8 | 28 | 28.6 | 1a1 | retouch | 5 | 33.1 | 26.6 | 8.8 | 0.6 | 5.7 | 1a1 | retouch | | 1 | |
| 1f3 | retouch | 2 | 19 | 10.5 | 1f3 | retouch | 2 | 33.1 | 18.8 | 6.2 | 0.3 | 3.2 | 1f3 | retouch | 1 | | |
| 1g1 | retouch | 5 | 12 | 41.7 | 1g1 | retouch | 13 | 48.0 | 28.1 | 13.5 | 1.0 | 9.6 | 1g1 | retouch | | 1 | |
| 1g7 | retouch | 0 | 9 | 0.0 | 1g7 | retouch | 10 | 37.6 | 15.5 | 5.8 | 1.7 | 17.2 | 1g7 | retouch | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1i/j3 | retouch | 8 | 21 | 38.1 | 1i/j3 | retouch | 3 | 37.9 | 16.6 | 6.3 | 0.5 | 4.8 | 1i/j3 | retouch | 1 | | |
| 21a5 | retouch | 9 | 13 | 69.2 | 21a5 | retouch | 4 | 33.0 | 31.0 | 10.2 | 0.4 | 3.9 | 21a5 | retouch | | 1 | |
| 21k8 | retouch | 5 | 11 | 45.5 | 21k8 | retouch | 2 | 29.0 | 22.0 | 6.4 | 0.3 | 3.1 | 21k8 | retouch | | 1 | |
| 21r4 | retouch | 2 | 20 | 10.0 | 21r4 | retouch | 3 | 41.4 | 19.5 | 8.1 | 0.4 | 3.7 | 21r4 | retouch | | | 1 |
| 23b | retouch | 4 | 16 | 25.0 | 23b | retouch | 1 | 40.5 | 20.3 | 8.2 | 0.1 | 1.2 | 23b | retouch | | 1 | |
| 23j | retouch | 4 | 10 | 40.0 | 23j | retouch | 3 | 37.3 | 24.3 | 9.1 | 0.3 | 3.3 | 23j | retouch | 1 | | |
| 23k2 | retouch | 5 | 15 | 33.3 | 23k2 | retouch | 1 | 35.2 | 21.4 | 7.5 | 0.1 | 1.3 | 23k2 | retouch | 1 | | |
| 28a | retouch | 12 | 17 | 70.6 | 28a | retouch | 3 | 54.6 | 44.5 | 24.3 | 0.1 | 1.2 | 28a | retouch | | 1 | |
| 28b | retouch | 3 | 13 | 23.1 | 28b | retouch | 4 | 28.2 | 20.3 | 5.7 | 0.7 | 7.0 | 28b | retouch | | 1 | |
| 29b | retouch | 9 | 12 | 75.0 | 29b | retouch | 1 | 32.4 | 26.6 | 8.6 | 0.1 | 1.2 | 29b | retouch | | | 1 |
| 29c | retouch | 3 | 21 | 14.3 | 29c | retouch | 0 | 31.1 | 28.6 | 8.9 | 0.0 | 0.0 | 29c | retouch | | 1 | |
| 29d2 | retouch | 5 | 15 | 33.3 | 29d2 | retouch | 5 | 32.0 | 25.2 | 8.1 | 0.6 | 6.2 | 29d2 | retouch | | 1 | |
| 29e | retouch | 10 | 25 | 40.0 | 29e | retouch | 1 | 67.7 | 32.8 | 22.2 | 0.0 | 0.5 | 29e | retouch | | 1 | |
| 30a | retouch | 4 | 19 | 21.1 | 30a | retouch | 5 | 51.7 | 32.3 | 16.7 | 0.3 | 3.0 | 30a | retouch | 1 | | |
| 30b | retouch | 10 | 36 | 27.8 | 30b | retouch | 5 | 52.5 | 47.4 | 24.9 | 0.2 | 2.0 | 30b | retouch | | 1 | |
| 30c | retouch | 1 | 15 | 6.7 | 30c | retouch | 1 | 28.4 | 27.0 | 7.7 | 0.1 | 1.3 | 30c | retouch | | 1 | |
| 30d | retouch | 8 | 35 | 22.9 | 30d | retouch | 2 | 46.8 | 33.3 | 15.6 | 0.1 | 1.3 | 30d | retouch | 1 | | |
| 30f | retouch | 5 | 15 | 33.3 | 30f | retouch | 12 | 24.8 | 21.4 | 5.3 | 2.3 | 22.6 | 30f | retouch | | 1 | |
| 30h1 | retouch | 0 | 22 | 0.0 | 30h1 | retouch | 0 | 40.0 | 22.6 | 9.0 | 0.0 | 0.0 | 30h1 | retouch | | 1 | |
| 30i3 | retouch | 3 | 8 | 37.5 | 30i3 | retouch | 0 | 29.0 | 15.6 | 4.5 | 0.0 | 0.0 | 30i3 | retouch | | 1 | |
| 32a3 | retouch | 5 | 13 | 38.5 | 32a3 | retouch | 3 | 30.4 | 22.7 | 6.9 | 0.4 | 4.3 | 32a3 | retouch | | | 1 |
| 33b12 | retouch | 5 | 9 | 55.6 | 33b12 | retouch | 7 | 20.6 | 17.4 | 3.6 | 2.0 | 19.5 | 33b12 | retouch | | 1 | |
| 33b6 | retouch | 11 | 23 | 47.8 | 33b6 | retouch | 4 | 46.3 | 25.4 | 11.8 | 0.3 | 3.4 | 33b6 | retouch | | 1 | |
| 38a1 | retouch | 7 | 19 | 36.8 | 38a1 | retouch | 51 | 42.3 | 35.1 | 14.8 | 3.4 | 34.3 | 38a1 | retouch | | 1 | |
| 38b3 | retouch | 6 | 17 | 35.3 | 38b3 | retouch | 13 | 43.2 | 28.0 | 12.1 | 1.1 | 10.7 | 38b3 | retouch | | | 1 |
| 38c4 | retouch | 6 | 24 | 25.0 | 38c4 | retouch | 3 | 28.2 | 26.3 | 7.4 | 0.4 | 4.0 | 38c4 | retouch | 1 | | |
| 39a5 | retouch | 7 | 19 | 36.8 | 39a5 | retouch | 21 | 42.0 | 30.0 | 12.6 | 1.7 | 16.7 | 39a5 | retouch | 1 | | |
| 39b5 | retouch | 7 | 25 | 28.0 | 39b5 | retouch | 3 | 37.0 | 19.0 | 7.0 | 0.4 | 4.3 | 39b5 | retouch | | 1 | |
| 39c5 | retouch | 5 | 16 | 31.3 | 39c5 | retouch | 3 | 33.4 | 19.3 | 6.4 | 0.5 | 4.7 | 39c5 | retouch | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40c5 | retouch | 4 | 14 | 28.6 | 40c5 | retouch | 7 | 23.1 | 18.0 | 4.2 | 1.7 | 16.8 | 40c5 | retouch | | 1 | |
| 40d5 | retouch | 3 | 20 | 15.0 | 40d5 | retouch | 6 | 33.2 | 18.6 | 6.2 | 1.0 | 9.7 | 40d5 | retouch | | 1 | |
| 41a6 | retouch | 6 | 19 | 31.6 | 41a6 | retouch | 13 | 35.0 | 21.6 | 7.6 | 1.7 | 17.2 | 41a6 | retouch | | 1 | |
| 41a7 | retouch | 13 | 23 | 56.5 | 41a7 | retouch | 1 | 39.8 | 18.7 | 7.4 | 0.1 | 1.3 | 41a7 | retouch | | 1 | |
| 41b2 | retouch | 10 | 25 | 40.0 | 41b2 | retouch | 1 | 36.2 | 23.2 | 8.4 | 0.1 | 1.2 | 41b2 | retouch | | 1 | |
| 42b6 | retouch | 7 | 12 | 58.3 | 42b6 | retouch | 9 | 28.8 | 27.5 | 7.9 | 1.1 | 11.4 | 42b6 | retouch | | 1 | |
| 42c6 | retouch | 3 | 20 | 15.0 | 42c6 | retouch | 6 | 33.4 | 26.0 | 8.7 | 0.7 | 6.9 | 42c6 | retouch | 1 | | |
| 43b5 | retouch | 5 | 14 | 35.7 | 43b5 | retouch | 11 | 24.9 | 21.5 | 5.4 | 2.1 | 20.5 | 43b5 | retouch | | 1 | |
| 43c5 | retouch | 5 | 18 | 27.8 | 43c5 | retouch | 7 | 40.5 | 27.1 | 11.0 | 0.6 | 6.4 | 43c5 | retouch | | 1 | |
| 44a4 | retouch | 6 | 16 | 37.5 | 44a4 | retouch | 7 | 39.6 | 36.0 | 14.3 | 0.5 | 4.9 | 44a4 | retouch | | 1 | |
| 44b6 | retouch | 3 | 24 | 12.5 | 44b6 | retouch | 7 | 31.4 | 23.8 | 7.5 | 0.9 | 9.4 | 44b6 | retouch | | 1 | |
| 44c5 | retouch | 10 | 17 | 58.8 | 44c5 | retouch | 4 | 42.0 | 25.0 | 10.5 | 0.4 | 3.8 | 44c5 | retouch | | 1 | |
| 45a5 | retouch | 4 | 19 | 21.1 | 45a5 | retouch | 10 | 39.1 | 24.9 | 9.7 | 1.0 | 10.3 | 45a5 | retouch | | 1 | |
| 45b3 | retouch | 2 | 16 | 12.5 | 45b3 | retouch | 1 | 19.8 | 15.1 | 3.0 | 0.3 | 3.3 | 45b3 | retouch | | 1 | |
| 47b | retouch | 5 | 28 | 17.9 | 47b | retouch | 11 | 57.2 | 33.7 | 19.3 | 0.6 | 5.7 | 47b | retouch | | 1 | |
| 47d | retouch | 6 | 16 | 37.5 | 47d | retouch | 5 | 32.6 | 19.7 | 6.4 | 0.8 | 7.8 | 47d | retouch | | 1 | |
| 47e | retouch | 0 | 17 | 0.0 | 47e | retouch | 1 | 29.5 | 19.6 | 5.8 | 0.2 | 1.7 | 47e | retouch | 1 | | |
| 47f | retouch | 1 | 14 | 7.1 | 47f | retouch | 2 | 28.6 | 18.2 | 5.2 | 0.4 | 3.8 | 47f | retouch | | 1 | |
| 47g | retouch | 0 | 19 | 0.0 | 47g | retouch | 1 | 25.1 | 19.0 | 4.8 | 0.2 | 2.1 | 47g | retouch | 1 | | |
| 47h | retouch | 3 | 15 | 20.0 | 47h | retouch | 1 | 24.5 | 14.6 | 3.6 | 0.3 | 2.8 | 47h | retouch | | 1 | |
| 50c | retouch | 6 | 15 | 40.0 | 50c | retouch | 1 | 36.8 | 27.1 | 10.0 | 0.1 | 1.0 | 50c | retouch | | | 1 |
| 50d | retouch | 2 | 9 | 22.2 | 50d | retouch | 1 | 27.0 | 20.5 | 5.5 | 0.2 | 1.8 | 50d | retouch | | 1 | |
| 50e | retouch | 4 | 9 | 44.4 | 50e | retouch | 3 | 28.8 | 6.5 | 1.9 | 1.6 | 16.0 | 50e | retouch | | 1 | |
| 50f | retouch | 8 | 15 | 53.3 | 50f | retouch | 2 | 30.0 | 24.2 | 7.3 | 0.3 | 2.8 | 50f | retouch | | 1 | |
| 51b | retouch | 2 | 8 | 25.0 | 51b | retouch | 3 | 27.7 | 15.3 | 4.2 | 0.7 | 7.1 | 51b | retouch | | 1 | |
| 51d | retouch | 2 | 10 | 20.0 | 51d | retouch | 4 | 35.8 | 18.2 | 6.5 | 0.6 | 6.1 | 51d | retouch | | 1 | |
| 51e | retouch | 4 | 12 | 33.3 | 51e | retouch | 4 | 17.7 | 13.4 | 2.4 | 1.7 | 16.9 | 51e | retouch | | 1 | |
| 51f | retouch | 3 | 9 | 33.3 | 51f | retouch | 1 | 22.7 | 11.0 | 2.5 | 0.4 | 4.0 | 51f | retouch | | 1 | |
| 51i | retouch | 14 | 14 | 100.0 | 51i | retouch | 1 | 31.6 | 26.0 | 8.2 | 0.1 | 1.2 | 51i | retouch | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51j | retouch | 2 | 12 | 16.7 | 51j | retouch | 0 | 21.9 | 21.3 | 4.7 | 0.0 | 0.0 | 51j | retouch | | 1 | |
| 52d | retouch | 8 | 28 | 28.6 | 52d | retouch | 10 | 58.0 | 43.2 | 25.1 | 0.4 | 4.0 | 52d | retouch | | 1 | |
| 52e | retouch | 4 | 15 | 26.7 | 52e | retouch | 1 | 45.8 | 25.8 | 11.8 | 0.1 | 0.8 | 52e | retouch | | 1 | |
| 52f | retouch | 2 | 17 | 11.8 | 52f | retouch | 5 | 47.8 | 24.8 | 11.9 | 0.4 | 4.2 | 52f | retouch | | 1 | |
| 53c | retouch | 2 | 10 | 20.0 | 53c | retouch | 4 | 29.0 | 17.5 | 5.1 | 0.8 | 7.9 | 53c | retouch | | 1 | |
| 53d | retouch | 5 | 16 | 31.3 | 53d | retouch | 3 | 33.8 | 28.3 | 9.6 | 0.3 | 3.1 | 53d | retouch | 1 | | |
| 54b4 | retouch | 6 | 18 | 33.3 | 54b4 | retouch | 10 | 51.0 | 21.9 | 11.2 | 0.9 | 9.0 | 54b4 | retouch | | 1 | |
| 55a,b4 | retouch | 8 | 23 | 34.8 | 55a,b4 | retouch | 9 | 46.5 | 27.8 | 12.9 | 0.7 | 7.0 | 55a,b4 | retouch | | 1 | |
| 56a4 | retouch | 7 | 26 | 26.9 | 56a4 | retouch | 5 | 33.0 | 25.8 | 8.5 | 0.6 | 5.9 | 56a4 | retouch | | 1 | |
| 57a4 | retouch | 3 | 12 | 25.0 | 57a4 | retouch | 4 | 18.7 | 11.0 | 2.1 | 1.9 | 19.4 | 57a4 | retouch | | 1 | |
| 57b4 | retouch | 4 | 17 | 23.5 | 57b4 | retouch | 2 | 21.8 | 12.8 | 2.8 | 0.7 | 7.2 | 57b4 | retouch | | 1 | |
| 5bdug11 | retouch | 4 | 7 | 57.1 | 5bdug11 | retouch | 6 | 18.1 | 16.1 | 2.9 | 2.1 | 20.6 | 5bdug11 | retouch | | | 1 |
| 5bdug8 | retouch | 5 | 14 | 35.7 | 5bdug8 | retouch | 8 | 29.7 | 20.0 | 5.9 | 1.3 | 13.5 | 5bdug8 | retouch | | | 1 |
| 5csurf1 | retouch | 4 | 11 | 36.4 | 5csurf1 | retouch | 0 | 30.8 | 17.7 | 5.5 | 0.0 | 0.0 | 5csurf1 | retouch | | | 1 |
| 5kdug1 | retouch | 2 | 13 | 15.4 | 5kdug1 | retouch | 10 | 40.0 | 25.8 | 10.3 | 1.0 | 9.7 | 5kdug1 | retouch | | 1 | |
| 5kdug6 | retouch | 4 | 19 | 21.1 | 5kdug6 | retouch | 2 | 19.0 | 18.1 | 3.4 | 0.6 | 5.8 | 5kdug6 | retouch | | 1 | |
| 6g3 | retouch | 0 | 14 | 0.0 | 6g3 | retouch | 4 | 26.3 | 25.8 | 6.8 | 0.6 | 5.9 | 6g3 | retouch | | 1 | |
| 6h2 | retouch | 3 | 25 | 12.0 | 6h2 | retouch | 2 | 48.4 | 38.0 | 18.4 | 0.1 | 1.1 | 6h2 | retouch | | 1 | |
| 6h6 | retouch | 4 | 16 | 25.0 | 6h6 | retouch | 3 | 27.9 | 23.2 | 6.5 | 0.5 | 4.6 | 6h6 | retouch | | 1 | |
| 8r1 | retouch | 2 | 10 | 20.0 | 8r1 | retouch | 1 | 23.0 | 17.8 | 4.1 | 0.2 | 2.4 | 8r1 | retouch | | 1 | |
| 8t1 | retouch | 3 | 10 | 30.0 | 8t1 | retouch | 3 | 33.0 | 22.8 | 7.5 | 0.4 | 4.0 | 8t1 | retouch | | 1 | |
| 8w1 | retouch | 0 | 15 | 0.0 | 8w1 | retouch | 0 | 28.2 | 26.8 | 7.6 | 0.0 | 0.0 | 8w1 | retouch | 1 | | |
| 8w5 | retouch | 2 | 27 | 7.4 | 8w5 | retouch | 4 | 40.5 | 39.3 | 15.9 | 0.3 | 2.5 | 8w5 | retouch | | 1 | |
| 8x11 | retouch | 4 | 12 | 33.3 | 8x11 | retouch | 4 | 24.0 | 20.1 | 4.8 | 0.8 | 8.3 | 8x11 | retouch | | | 1 |
| 8x4 | retouch | 6 | 17 | 35.3 | 8x4 | retouch | 3 | 34.1 | 28.5 | 9.7 | 0.3 | 3.1 | 8x4 | retouch | | 1 | |
| 9b13 | retouch | 5 | 11 | 45.5 | 9b13 | retouch | 4 | 39.7 | 39.7 | 15.8 | 0.3 | 2.5 | 9b13 | retouch | | 1 | |
| 9c17 | retouch | 6 | 23 | 26.1 | 9c17 | retouch | 10 | 43.4 | 40.3 | 17.5 | 0.6 | 5.7 | 9c17 | retouch | | 1 | |
| 9c7 | retouch | 7 | 9 | 77.8 | 9c7 | retouch | 7 | 28.2 | 20.5 | 5.8 | 1.2 | 12.1 | 9c7 | retouch | | 1 | |
| 9d18 | retouch | 6 | 18 | 33.3 | 9d18 | retouch | 8 | 33.0 | 28.8 | 9.5 | 0.8 | 8.4 | 9d18 | retouch | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9g11 | retouch | 7 | 27 | 25.9 | 9g11 | retouch | 22 | 76.7 | 28.0 | 21.5 | 1.0 | 10.2 | 9g11 | retouch | | 1 | |
| 9g8 | retouch | 4 | 11 | 36.4 | 9g8 | retouch | 14 | 48.0 | 31.7 | 15.2 | 0.9 | 9.2 | 9g8 | retouch | | 1 | |
| 9h10 | retouch | 2 | 18 | 11.1 | 9h10 | retouch | 0 | 38.0 | 32.6 | 12.4 | 0.0 | 0.0 | 9h10 | retouch | 1 | | |
| 9i12 | retouch | 5 | 23 | 21.7 | 9i12 | retouch | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i12 | retouch | | 1 | |
| 9L10 | retouch | 2 | 10 | 20.0 | 9L10 | retouch | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L10 | retouch | 1 | | |
| 9L18 | retouch | 3 | 13 | 23.1 | 9L18 | retouch | 3 | 31.5 | 15.8 | 5.0 | 0.6 | 6.0 | 9L18 | retouch | | 1 | |
| 9n7 | retouch | 8 | 15 | 53.3 | 9n7 | retouch | 1 | 26.0 | 26.0 | 6.8 | 0.1 | 1.5 | 9n7 | retouch | | 1 | |
| 9n9 | retouch | 3 | 11 | 27.3 | 9n9 | retouch | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n9 | retouch | | 1 | |
| 9o17 | retouch | 10 | 37 | 27.0 | 9o17 | retouch | 3 | 48.6 | 44.0 | 21.4 | 0.1 | 1.4 | 9o17 | retouch | | 1 | |
| 9p3 | retouch | 2 | 12 | 16.7 | 9p3 | retouch | 4 | 18.2 | 17.5 | 3.2 | 1.3 | 12.6 | 9p3 | retouch | | 1 | |
| **a5** | retouch | 5 | 13 | 38.5 | **a5** | retouch | 3 | 31.2 | 28.5 | 8.9 | 0.3 | 3.4 | **a5** | retouch | | 1 | |
| S18e6 | retouch | 4 | 12 | 33.3 | S18e6 | retouch | 16 | 41.3 | 26.0 | 10.7 | 1.5 | 14.9 | S18e6 | retouch | | | 1 |
| S19e1 | retouch | 0 | 24 | 0.0 | S19e1 | retouch | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | S19e1 | retouch | 1 | | |
| S30e6 | retouch | 4 | 15 | 26.7 | S30e6 | retouch | 1 | 42.0 | 33.5 | 14.1 | 0.1 | 0.7 | S30e6 | retouch | | 1 | |
| 10s6 | retouch | 4 | 9 | 44.4 | 10s6 | retouch | 12 | 37.2 | 28.0 | 10.4 | 1.2 | 11.5 | 10s6 | retouch | | 1 | |
| 10h7 | scraper | 11 | 15 | 73.3 | 10h7 | scraper | 22 | 46.8 | 29.0 | 13.6 | 1.6 | 16.2 | 10h7 | scraper | | 1 | |
| 10h8 | scraper | 9 | 18 | 50.0 | 10h8 | scraper | 13 | 40.0 | 41.7 | 16.7 | 0.8 | 7.8 | 10h8 | scraper | | 1 | |
| 10m4 | scraper | 3 | 9 | 33.3 | 10m4 | scraper | 2 | 27.0 | 18.5 | 5.0 | 0.4 | 4.0 | 10m4 | scraper | | 1 | |
| 10m7 | scraper | 6 | 9 | 66.7 | 10m7 | scraper | 1 | 38.0 | 22.5 | 8.6 | 0.1 | 1.2 | 10m7 | scraper | | 1 | |
| 10s5 | scraper | 12 | 18 | 66.7 | 10s5 | scraper | 15 | 27.0 | 25.6 | 6.9 | 2.2 | 21.7 | 10s5 | scraper | | 1 | |
| 10s7 | scraper | 5 | 22 | 22.7 | 10s7 | scraper | 12 | 36.5 | 26.7 | 9.7 | 1.2 | 12.3 | 10s7 | scraper | | 1 | |
| 10v1 | scraper | 6 | 25 | 24.0 | 10v1 | scraper | 2 | 43.6 | 27.5 | 12.0 | 0.2 | 1.7 | 10v1 | scraper | | 1 | |
| 11a5 | scraper | 15 | 21 | 71.4 | 11a5 | scraper | 16 | 46.8 | 45.0 | 21.1 | 0.8 | 7.6 | 11a5 | scraper | | 1 | |
| 11a7 | scraper | 14 | 19 | 73.7 | 11a7 | scraper | 7 | 41.4 | 12.0 | 5.0 | 1.4 | 14.1 | 11a7 | scraper | | 1 | |
| 13a2 | scraper | 3 | 7 | 42.9 | 13a2 | scraper | 2 | 31.0 | 27.5 | 8.5 | 0.2 | 2.3 | 13a2 | scraper | | | 1 |
| 13a4 | scraper | 6 | 7 | 85.7 | 13a4 | scraper | 0 | 26.6 | 26.4 | 7.0 | 0.0 | 0.0 | 13a4 | scraper | | | 1 |
| 14b1 | scraper | 5 | 15 | 33.3 | 14b1 | scraper | 1 | 44.7 | 42.2 | 18.9 | 0.1 | 0.5 | 14b1 | scraper | | 1 | |
| 14k4 | scraper | 5 | 11 | 45.5 | 14k4 | scraper | 2 | 38.7 | 34.4 | 13.3 | 0.2 | 1.5 | 14k4 | scraper | | | 1 |
| 14m3 | scraper | 3 | 23 | 13.0 | 14m3 | scraper | 3 | 44.4 | 36.7 | 16.3 | 0.2 | 1.8 | 14m3 | scraper | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15a12 | scraper | 10 | 24 | 41.7 | 15a12 | scraper | 4 | 37.3 | 24.4 | 9.1 | 0.4 | 4.4 | 15a12 | scraper | | 1 | |
| 15a6 | scraper | 10 | 16 | 62.5 | 15a6 | scraper | 3 | 54.5 | 44.0 | 24.0 | 0.1 | 1.3 | 15a6 | scraper | | 1 | |
| 15b4 | scraper | 6 | 10 | 60.0 | 15b4 | scraper | 11 | 31.3 | 29.0 | 9.1 | 1.2 | 12.1 | 15b4 | scraper | | 1 | |
| 15b7 | scraper | 12 | 17 | 70.6 | 15b7 | scraper | 13 | 48.2 | 34.8 | 16.8 | 0.8 | 7.8 | 15b7 | scraper | | 1 | |
| 15d2 | scraper | 4 | 21 | 19.0 | 15d2 | scraper | 1 | 46.2 | 31.7 | 14.6 | 0.1 | 0.7 | 15d2 | scraper | 1 | | |
| 15g13 | scraper | 15 | 15 | 100.0 | 15g13 | scraper | 10 | 30.2 | 19.9 | 6.0 | 1.7 | 16.6 | 15g13 | scraper | | | 1 |
| 15g3 | scraper | 20 | 20 | 100.0 | 15g3 | scraper | 2 | 38.8 | 15.2 | 5.9 | 0.3 | 3.4 | 15g3 | scraper | | | 1 |
| 15i10 | scraper | 3 | 18 | 16.7 | 15i10 | scraper | 5 | 34.6 | 23.0 | 8.0 | 0.6 | 6.3 | 15i10 | scraper | | 1 | |
| 15i5 | scraper | 2 | 9 | 22.2 | 15i5 | scraper | 2 | 22.6 | 21.0 | 4.7 | 0.4 | 4.2 | 15i5 | scraper | | 1 | |
| 15k12 | scraper | 5 | 21 | 23.8 | 15k12 | scraper | 7 | 26.6 | 25.0 | 6.7 | 1.1 | 10.5 | 15k12 | scraper | | 1 | |
| 15k13 | scraper | 3 | 22 | 13.6 | 15k13 | scraper | 2 | 25.2 | 24.6 | 6.2 | 0.3 | 3.2 | 15k13 | scraper | | 1 | |
| 16a11 | scraper | 3 | 21 | 14.3 | 16a11 | scraper | 9 | 41.4 | 32.4 | 13.4 | 0.7 | 6.7 | 16a11 | scraper | 1 | | |
| 16a7 | scraper | 1 | 22 | 4.5 | 16a7 | scraper | 1 | 35.7 | 30.5 | 10.9 | 0.1 | 0.9 | 16a7 | scraper | 1 | | |
| 16c11 | scraper | 1 | 29 | 3.4 | 16c11 | scraper | 0 | 30 | 25.6 | 7.7 | 0.0 | 0.0 | 16c11 | scraper | 1 | | |
| 16d2 | scraper | 16 | 20 | 80.0 | 16d2 | scraper | 4 | 55 | 19.2 | 10.6 | 0.4 | 3.8 | 16d2 | scraper | | 1 | |
| 16f7 | scraper | 2 | 13 | 15.4 | 16f7 | scraper | 2 | 34.5 | 27.5 | 9.5 | 0.2 | 2.1 | 16f7 | scraper | | 1 | |
| 16f9 | scraper | 5 | 16 | 31.3 | 16f9 | scraper | 10 | 52.0 | 42.7 | 22.2 | 0.5 | 4.5 | 16f9 | scraper | | 1 | |
| 16g2 | scraper | 6 | 19 | 31.6 | 16g2 | scraper | 4 | 37.7 | 33.4 | 12.6 | 0.3 | 3.2 | 16g2 | scraper | | 1 | |
| 16h2 | scraper | 13 | 13 | 100.0 | 16h2 | scraper | 8 | 27.5 | 19 | 5.2 | 1.5 | 15.3 | 16h2 | scraper | 1 | | |
| 16h3 | scraper | 11 | 26 | 42.3 | 16h3 | scraper | 4 | 41.0 | 15.3 | 6.3 | 0.6 | 6.4 | 16h3 | scraper | 1 | | |
| 17a,b,c8 | scraper | 3 | 16 | 18.8 | 17a,b,c8 | scraper | 3 | 46.8 | 43.9 | 20.5 | 0.1 | 1.5 | 17a,b,c8 | scraper | | 1 | |
| 17a,b,c9 | scraper | 15 | 15 | 100.0 | 17a,b,c9 | scraper | 2 | 48.0 | 28.2 | 13.5 | 0.1 | 1.5 | 17a,b,c9 | scraper | | 1 | |
| 18a1 | scraper | 8 | 14 | 57.1 | 18a1 | scraper | 28 | 46.0 | 28.0 | 12.9 | 2.2 | 21.7 | 18a1 | scraper | | 1 | |
| 18b14 | scraper | 6 | 18 | 33.3 | 18b14 | scraper | 15 | 35.1 | 29.2 | 10.2 | 1.5 | 14.6 | 18b14 | scraper | | 1 | |
| 18b5 | scraper | 8 | 17 | 47.1 | 18b5 | scraper | 13 | 35.6 | 24.2 | 8.6 | 1.5 | 15.1 | 18b5 | scraper | | 1 | |
| 18c10 | scraper | 19 | 25 | 76.0 | 18c10 | scraper | 15 | 40.0 | 34.8 | 13.9 | 1.1 | 10.8 | 18c10 | scraper | | 1 | |
| 18c6 | scraper | 8 | 16 | 50.0 | 18c6 | scraper | 18 | 43.8 | 35.0 | 15.3 | 1.2 | 11.7 | 18c6 | scraper | | 1 | |
| 18d3 | scraper | 0 | 6 | 0.0 | 18d3 | scraper | 9 | 36.2 | 28.4 | 10.3 | 0.9 | 8.8 | 18d3 | scraper | | | 1 |
| 19a1 | scraper | 0 | 13 | 0.0 | 19a1 | scraper | 0 | 35.0 | 18.6 | 6.5 | 0.0 | 0.0 | 19a1 | scraper | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19b1 | scraper | 11 | 27 | 40.7 | 19b1 | scraper | 10 | 43 | 39 | 16.8 | 0.6 | 6.0 | 19b1 | scraper | | 1 | |
| 19d4 | scraper | 5 | 8 | 62.5 | 19d4 | scraper | 5 | 33.0 | 23.2 | 7.7 | 0.7 | 6.5 | 19d4 | scraper | | 1 | |
| 19d5 | scraper | 2 | 15 | 13.3 | 19d5 | scraper | 12 | 32.0 | 32.0 | 10.2 | 1.2 | 11.7 | 19d5 | scraper | | 1 | |
| 1a3 | scraper | 5 | 20 | 25.0 | 1a3 | scraper | 8 | 43.7 | 25.4 | 11.1 | 0.7 | 7.2 | 1a3 | scraper | | 1 | |
| 1b1 | scraper | 6 | 18 | 33.3 | 1b1 | scraper | 5 | 42.8 | 29.3 | 12.5 | 0.4 | 4.0 | 1b1 | scraper | | 1 | |
| 1c1 | scraper | 1 | 14 | 7.1 | 1c1 | scraper | 1 | 18.2 | 21.2 | 3.9 | 0.3 | 2.6 | 1c1 | scraper | 1 | | |
| 1g2 | scraper | 1 | 36 | 2.8 | 1g2 | scraper | 3 | 56.3 | 34.1 | 19.2 | 0.2 | 1.6 | 1g2 | scraper | | 1 | |
| 1i/j5 | scraper | 8 | 24 | 33.3 | 1i/j5 | scraper | 3 | 41.4 | 35.3 | 14.6 | 0.2 | 2.1 | 1i/j5 | scraper | 1 | | |
| 20af2 | scraper | 9 | 12 | 75.0 | 20af2 | scraper | 4 | 28.2 | 23.0 | 6.5 | 0.6 | 6.2 | 20af2 | scraper | | 1 | |
| 21a9 | scraper | 8 | 14 | 57.1 | 21a9 | scraper | 15 | 69.2 | 53.0 | 36.7 | 0.4 | 4.1 | 21a9 | scraper | | 1 | |
| 21k9 | scraper | 3 | 11 | 27.3 | 21k9 | scraper | 1 | 43.0 | 29.0 | 12.5 | 0.1 | 0.8 | 21k9 | scraper | | 1 | |
| 22a | scraper | 5 | 16 | 31.3 | 22a | scraper | 2 | 34.8 | 33.4 | 11.6 | 0.2 | 1.7 | 22a | scraper | | 1 | |
| 23b | scraper | 6 | 11 | 54.5 | 23b | scraper | 4 | 35.4 | 27.7 | 9.8 | 0.4 | 4.1 | 23b | scraper | | 1 | |
| 23b | scraper | 14 | 19 | 73.7 | 23b | scraper | 10 | 43.8 | 28.0 | 12.3 | 0.8 | 8.2 | 23b | scraper | | 1 | |
| 23j | scraper | 7 | 15 | 46.7 | 23j | scraper | 1 | 28.9 | 25.7 | 7.4 | 0.1 | 1.3 | 23j | scraper | 1 | | |
| 23k | scraper | 1 | 12 | 8.3 | 23k | scraper | 0 | 33.6 | 26.5 | 8.9 | 0.0 | 0.0 | 23k | scraper | 1 | | |
| 28a | scraper | 8 | 15 | 53.3 | 28a | scraper | 2 | 33.3 | 30.3 | 10.1 | 0.2 | 2.0 | 28a | scraper | | 1 | |
| 28b | scraper | 4 | 11 | 36.4 | 28b | scraper | 4 | 39.7 | 32.0 | 12.7 | 0.3 | 3.1 | 28b | scraper | | 1 | |
| 28g | scraper | 0 | 19 | 0.0 | 28g | scraper | 1 | 48.2 | 23.3 | 11.2 | 0.1 | 0.9 | 28g | scraper | | 1 | |
| 29a | scraper | 15 | 15 | 100.0 | 29a | scraper | 6 | 35.8 | 34.5 | 12.4 | 0.5 | 4.9 | 29a | scraper | | | 1 |
| 29c | scraper | 1 | 11 | 9.1 | 29c | scraper | 1 | 27.6 | 21.7 | 6.0 | 0.2 | 1.7 | 29c | scraper | | | 1 |
| 30a | scraper | 2 | 20 | 10.0 | 30a | scraper | 0 | 46.0 | 29.8 | 13.7 | 0.0 | 0.0 | 30a | scraper | | 1 | |
| 30b | scraper | 3 | 17 | 17.6 | 30b | scraper | 1 | 31.4 | 23.5 | 7.4 | 0.1 | 1.4 | 30b | scraper | | | 1 |
| 30c | scraper | 9 | 17 | 52.9 | 30c | scraper | 5 | 38.6 | 36.7 | 14.2 | 0.4 | 3.5 | 30c | scraper | | 1 | |
| 30f | scraper | 3 | 11 | 27.3 | 30f | scraper | 5 | 25.7 | 23.3 | 6.0 | 0.8 | 8.3 | 30f | scraper | | 1 | |
| 30g | scraper | 4 | 15 | 26.7 | 30g | scraper | 2 | 24.8 | 25.9 | 6.4 | 0.3 | 3.1 | 30g | scraper | | 1 | |
| 30i2 | scraper | 6 | 15 | 40.0 | 30i2 | scraper | 2 | 22.4 | 16.0 | 3.6 | 0.6 | 5.6 | 30i2 | scraper | | 1 | |
| 30k3 | scraper | 11 | 24 | 45.8 | 30k3 | scraper | 1 | 46.2 | 43.0 | 19.9 | 0.1 | 0.5 | 30k3 | scraper | | 1 | |
| 32a4 | scraper | 16 | 20 | 80.0 | 32a4 | scraper | 10 | 40.0 | 16.0 | 6.4 | 1.6 | 15.6 | 32a4 | scraper | | | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33b11 | scraper | 5 | 19 | 26.3 | 33b11 | scraper | 6 | 32.9 | 24.4 | 8.0 | 0.7 | 7.5 | 33b11 | scraper | | 1 | |
| 33b8 | scraper | 8 | 19 | 42.1 | 33b8 | scraper | 12 | 51.0 | 33.6 | 17.1 | 0.7 | 7.0 | 33b8 | scraper | | 1 | |
| 34b2 | scraper | 5 | 17 | 29.4 | 34b2 | scraper | 2 | 27.6 | 22.0 | 6.1 | 0.3 | 3.3 | 34b2 | scraper | | 1 | |
| 38b2 | scraper | 16 | 34 | 47.1 | 38b2 | scraper | 22 | 44.2 | 32.0 | 14.1 | 1.6 | 15.6 | 38b2 | scraper | | 1 | |
| 38c5 | scraper | 6 | 21 | 28.6 | 38c5 | scraper | 3 | 28.7 | 25.8 | 7.4 | 0.4 | 4.1 | 38c5 | scraper | 1 | | |
| 38d2 | scraper | 2 | 15 | 13.3 | 38d2 | scraper | 4 | 40.5 | 21.7 | 8.8 | 0.5 | 4.6 | 38d2 | scraper | | | 1 |
| 39a4 | scraper | 14 | 20 | 70.0 | 39a4 | scraper | 23 | 50.0 | 36.0 | 18.0 | 1.3 | 12.8 | 39a4 | scraper | 1 | | |
| 39b4 | scraper | 2 | 18 | 11.1 | 39b4 | scraper | 5 | 43.0 | 18.0 | 7.7 | 0.6 | 6.5 | 39b4 | scraper | | 1 | |
| 39c4 | scraper | 1 | 8 | 12.5 | 39c4 | scraper | 0 | 38.0 | 22.4 | 8.5 | 0.0 | 0.0 | 39c4 | scraper | 1 | | |
| 40a6 | scraper | 9 | 20 | 45.0 | 40a6 | scraper | 13 | 30.0 | 22.8 | 6.8 | 1.9 | 19.0 | 40a6 | scraper | 1 | | |
| 40c6 | scraper | 3 | 13 | 23.1 | 40c6 | scraper | 13 | 28.7 | 16.0 | 4.6 | 2.8 | 28.3 | 40c6 | scraper | | 1 | |
| 40d6 | scraper | 14 | 18 | 77.8 | 40d6 | scraper | 8 | 40.3 | 7.2 | 2.9 | 2.8 | 27.6 | 40d6 | scraper | | 1 | |
| 41a8 | scraper | 7 | 16 | 43.8 | 41a8 | scraper | 1 | 46.5 | 19.6 | 9.1 | 0.1 | 1.1 | 41a8 | scraper | | 1 | |
| 42b5 | scraper | 5 | 18 | 27.8 | 42b5 | scraper | 13 | 52.6 | 28.6 | 15.0 | 0.9 | 8.6 | 42b5 | scraper | | 1 | |
| 42c5 | scraper | 3 | 21 | 14.3 | 42c5 | scraper | 4 | 40.2 | 20.5 | 8.2 | 0.5 | 4.9 | 42c5 | scraper | 1 | | |
| 43b4 | scraper | 5 | 14 | 35.7 | 43b4 | scraper | 4 | 32.3 | 21.9 | 7.1 | 0.6 | 5.7 | 43b4 | scraper | | 1 | |
| 43c4 | scraper | 7 | 18 | 38.9 | 43c4 | scraper | 5 | 35.5 | 27.9 | 9.9 | 0.5 | 5.0 | 43c4 | scraper | | 1 | |
| 44a3 | scraper | 15 | 20 | 75.0 | 44a3 | scraper | 8 | 32.6 | 28.9 | 9.4 | 0.8 | 8.5 | 44a3 | scraper | | 1 | |
| 44b5 | scraper | 7 | 12 | 58.3 | 44b5 | scraper | 1 | 28.2 | 18.8 | 5.3 | 0.2 | 1.9 | 44b5 | scraper | | 1 | |
| 44c4 | scraper | 5 | 19 | 26.3 | 44c4 | scraper | 2 | 43.6 | 21.5 | 9.4 | 0.2 | 2.1 | 44c4 | scraper | | 1 | |
| 45a4 | scraper | 3 | 18 | 16.7 | 45a4 | scraper | 7 | 47.7 | 26.8 | 12.8 | 0.5 | 5.5 | 45a4 | scraper | | 1 | |
| 45b2 | scraper | 12 | 16 | 75.0 | 45b2 | scraper | 9 | 22.5 | 21.8 | 4.9 | 1.8 | 18.3 | 45b2 | scraper | | 1 | |
| 47a | scraper | 2 | 20 | 10.0 | 47a | scraper | 4 | 42.5 | 26.7 | 11.3 | 0.4 | 3.5 | 47a | scraper | 1 | | |
| 47b | scraper | 3 | 17 | 17.6 | 47b | scraper | 11 | 49.2 | 44.1 | 21.7 | 0.5 | 5.1 | 47b | scraper | | 1 | |
| 47d | scraper | 6 | 15 | 40.0 | 47d | scraper | 3 | 39.2 | 22.6 | 8.9 | 0.3 | 3.4 | 47d | scraper | | 1 | |
| 47f | scraper | 4 | 12 | 33.3 | 47f | scraper | 10 | 24.7 | 20.8 | 5.1 | 1.9 | 19.5 | 47f | scraper | | 1 | |
| 47g | scraper | 4 | 8 | 50.0 | 47g | scraper | 1 | 37.7 | 25.2 | 9.5 | 0.1 | 1.1 | 47g | scraper | | 1 | |
| 47h | scraper | 4 | 11 | 36.4 | 47h | scraper | 2 | 38.9 | 27.9 | 10.9 | 0.2 | 1.8 | 47h | scraper | 1 | | |
| 47i | scraper | 3 | 18 | 16.7 | 47i | scraper | 3 | 36.4 | 24.7 | 9.0 | 0.3 | 3.3 | 47i | scraper | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50e | scraper | 10 | 14 | 71.4 | 50e | scraper | 4 | 41.6 | 21.5 | 8.9 | 0.4 | 4.5 | 50e | scraper | | 1 | |
| 50f | scraper | 4 | 16 | 25.0 | 50f | scraper | 1 | 30.2 | 21.9 | 6.6 | 0.2 | 1.5 | 50f | scraper | | 1 | |
| 50h | scraper | 11 | 13 | 84.6 | 50h | scraper | 2 | 39.7 | 30.5 | 12.1 | 0.2 | 1.7 | 50h | scraper | | 1 | |
| 51a | scraper | 7 | 13 | 53.8 | 51a | scraper | 1 | 58.0 | 35.9 | 20.8 | 0.0 | 0.5 | 51a | scraper | | | 1 |
| 51b | scraper | 1 | 12 | 8.3 | 51b | scraper | 1 | 23.7 | 22.7 | 5.4 | 0.2 | 1.9 | 51b | scraper | | 1 | |
| 51d | scraper | 2 | 25 | 8.0 | 51d | scraper | 2 | 37.3 | 26.5 | 9.9 | 0.2 | 2.0 | 51d | scraper | | 1 | |
| 51e | scraper | 15 | 17 | 88.2 | 51e | scraper | 11 | 38.6 | 29.2 | 11.3 | 1.0 | 9.8 | 51e | scraper | | 1 | |
| 51f | scraper | 4 | 22 | 18.2 | 51f | scraper | 19 | 36.0 | 23.7 | 8.5 | 2.2 | 22.3 | 51f | scraper | | 1 | |
| 51j | scraper | 1 | 18 | 5.6 | 51j | scraper | 1 | 27.6 | 21.5 | 5.9 | 0.2 | 1.7 | 51j | scraper | | 1 | |
| 52b | scraper | 8 | 14 | 57.1 | 52b | scraper | 4 | 37.3 | 36.0 | 13.4 | 0.3 | 3.0 | 52b | scraper | | 1 | |
| 52c | scraper | 4 | 21 | 19.0 | 52c | scraper | 3 | 38.2 | 23.9 | 9.1 | 0.3 | 3.3 | 52c | scraper | | 1 | |
| 52g | scraper | 2 | 24 | 8.3 | 52g | scraper | 2 | 40.0 | 35.4 | 14.2 | 0.1 | 1.4 | 52g | scraper | | 1 | |
| 53c | scraper | 8 | 22 | 36.4 | 53c | scraper | 5 | 43.6 | 35.8 | 15.6 | 0.3 | 3.2 | 53c | scraper | | 1 | |
| 53d | scraper | 4 | 24 | 16.7 | 53d | scraper | 2 | 39.0 | 25.2 | 9.8 | 0.2 | 2.0 | 53d | scraper | 1 | | |
| 54b5 | scraper | 10 | 23 | 43.5 | 54b5 | scraper | 14 | 37.8 | 26.9 | 10.2 | 1.4 | 13.8 | 54b5 | scraper | | 1 | |
| 55a,b5 | scraper | 9 | 39 | 23.1 | 55a,b5 | scraper | 12 | 55.0 | 42.4 | 23.3 | 0.5 | 5.1 | 55a,b5 | scraper | | 1 | |
| 56a5 | scraper | 10 | 18 | 55.6 | 56a5 | scraper | 7 | 30.8 | 24.2 | 7.5 | 0.9 | 9.4 | 56a5 | scraper | | | 1 |
| 57a5 | scraper | 9 | 13 | 69.2 | 57a5 | scraper | 12 | 35.8 | 19.5 | 7.0 | 1.7 | 17.2 | 57a5 | scraper | | 1 | |
| 57b5 | scraper | 7 | 32 | 21.9 | 57b5 | scraper | 10 | 33.0 | 29.8 | 9.8 | 1.0 | 10.2 | 57b5 | scraper | | 1 | |
| 5bdug7 | scraper | 8 | 9 | 88.9 | 5bdug7 | scraper | 11 | 27.0 | 21.3 | 5.8 | 1.9 | 19.1 | 5bdug7 | scraper | | | 1 |
| 5bdug9 | scraper | 16 | 25 | 64.0 | 5bdug9 | scraper | 8 | 25.0 | 25.0 | 6.3 | 1.3 | 12.8 | 5bdug9 | scraper | | | 1 |
| 5kdug2 | scraper | 2 | 18 | 11.1 | 5kdug2 | scraper | 2 | 29.0 | 23.0 | 6.7 | 0.3 | 3.0 | 5kdug2 | scraper | | 1 | |
| 6g2 | scraper | 4 | 19 | 21.1 | 6g2 | scraper | 0 | 39.6 | 37.6 | 14.9 | 0.0 | 0.0 | 6g2 | scraper | | 1 | |
| 6h3 | scraper | 0 | 16 | 0.0 | 6h3 | scraper | 2 | 53.6 | 37.3 | 20.0 | 0.1 | 1.0 | 6h3 | scraper | | 1 | |
| 8p1 | scraper | 2 | 10 | 20.0 | 8p1 | scraper | 4 | 28.5 | 23.7 | 6.8 | 0.6 | 5.9 | 8p1 | scraper | | 1 | |
| 8r3 | scraper | 5 | 17 | 29.4 | 8r3 | scraper | 2 | 41.4 | 21.8 | 9.0 | 0.2 | 2.2 | 8r3 | scraper | | 1 | |
| 8s1 | scraper | 0 | 18 | 0.0 | 8s1 | scraper | 0 | 32.3 | 31.8 | 10.3 | 0.0 | 0.0 | 8s1 | scraper | | 1 | |
| 8t2 | scraper | 3 | 23 | 13.0 | 8t2 | scraper | 8 | 45.0 | 36.0 | 16.2 | 0.5 | 4.9 | 8t2 | scraper | | 1 | |
| 8w2 | scraper | 1 | 21 | 4.8 | 8w2 | scraper | 3 | 36.4 | 31.0 | 11.3 | 0.3 | 2.7 | 8w2 | scraper | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8w4 | scraper | 5 | 23 | 21.7 | 8w4 | scraper | 3 | 42.2 | 31.0 | 13.1 | 0.2 | 2.3 | 8w4 | scraper | | 1 | |
| 8x12 | scraper | 10 | 14 | 71.4 | 8x12 | scraper | 18 | 41.3 | 23.0 | 9.5 | 1.9 | 18.9 | 8x12 | scraper | | 1 | |
| 8x9 | scraper | 8 | 10 | 80.0 | 8x9 | scraper | 3 | 51.0 | 37.3 | 19.0 | 0.2 | 1.6 | 8x9 | scraper | | 1 | |
| 9a5 | scraper | 12 | 17 | 70.6 | 9a5 | scraper | 14 | 37.0 | 27.3 | 10.1 | 1.4 | 13.9 | 9a5 | scraper | | 1 | |
| 9c14 | scraper | 5 | 10 | 50.0 | 9c14 | scraper | 2 | 18.4 | 12.4 | 2.3 | 0.9 | 8.8 | 9c14 | scraper | | 1 | |
| 9g14 | scraper | 4 | 12 | 33.3 | 9g14 | scraper | 13 | 18.9 | 15.5 | 2.9 | 4.4 | 44.4 | 9g14 | scraper | | 1 | |
| 9h15 | scraper | 0 | 7 | 0.0 | 9h15 | scraper | 0 | 20.0 | 20.0 | 4.0 | 0.0 | 0.0 | 9h15 | scraper | 1 | | |
| 9i14 | scraper | 2 | 14 | 14.3 | 9i14 | scraper | 4 | 27.0 | 26.7 | 7.2 | 0.6 | 5.5 | 9i14 | scraper | | 1 | |
| 9L17 | scraper | 5 | 14 | 35.7 | 9L17 | scraper | 0 | 21.3 | 17.0 | 3.6 | 0.0 | 0.0 | 9L17 | scraper | 1 | | |
| 9L6 | scraper | 2 | 13 | 15.4 | 9L6 | scraper | 0 | 16.0 | 14.7 | 2.4 | 0.0 | 0.0 | 9L6 | scraper | 1 | | |
| 9n14 | scraper | 3 | 13 | 23.1 | 9n14 | scraper | 1 | 28.6 | 28.0 | 8.0 | 0.1 | 1.2 | 9n14 | scraper | | 1 | |
| 9n17 | scraper | 7 | 8 | 87.5 | 9n17 | scraper | 6 | 22.3 | 19.6 | 4.3708 | 1.3727 | 13.7 | 9n17 | scraper | | 1 | |
| 9o15 | scraper | 5 | 16 | 31.3 | 9o15 | scraper | 2 | 35.7 | 25.4 | 9.1 | 0.2 | 2.2 | 9o15 | scraper | | 1 | |
| S18e2 | scraper | 3 | 14 | 21.4 | S18e2 | scraper | 10 | 21.7 | 19.2 | 4.2 | 2.4 | 24.0 | S18e2 | scraper | | | 1 |
| S21e3 | scraper | 5 | 14 | 35.7 | S21e3 | scraper | 2 | 53.2 | 38.8 | 20.6 | 0.1 | 1.0 | S21e3 | scraper | | | 1 |
| S23e1 | scraper | 7 | 12 | 58.3 | S23e1 | scraper | 7 | 36.3 | 34.5 | 12.5 | 0.6 | 5.6 | S23e1 | scraper | | 1 | |
| S30e4 | scraper | 6 | 14 | 42.9 | S30e4 | scraper | 0 | 36.0 | 30.0 | 10.8 | 0.0 | 0.0 | S30e4 | scraper | | 1 | |
| s41e2 | scraper | 2 | 17 | 11.8 | s41e2 | scraper | 0 | 34.0 | 23.9 | 8.1 | 0.0 | 0.0 | s41e2 | scraper | | 1 | |
| 21a1 | scraper | 4 | 9 | 44.4 | 21a1 | scraper | 7 | 29.7 | 27.0 | 8.0 | 0.9 | 8.7 | 21a1 | scraper | | 1 | |
| 8w6 | scraper | 3 | 10 | 30.0 | 8w6 | scraper | 7 | 47.2 | 28.8 | 13.6 | 0.5 | 5.1 | 8w6 | scraper | | 1 | |
| 8u1 | scraper | 8 | 10 | 80.0 | 8u1 | scraper | 6 | 60.0 | 31.5 | 18.9 | 0.3 | 3.2 | 8u1 | scraper | | 1 | |
| 10r1 | scraper | 2 | 9 | 22.2 | 10r1 | scraper | 2 | 23.0 | 19.3 | 4.4 | 0.5 | 4.5 | 10r1 | scraper | | 1 | |
| 10r2 | scraper | 2 | 11 | 18.2 | 10r2 | scraper | 1 | 30.7 | 26.3 | 8.1 | 0.1 | 1.2 | 10r2 | scraper | | 1 | |
| 11b3 | scraper | 7 | 21 | 33.3 | 11b3 | scraper | 2 | 61.4 | 45.0 | 27.6 | 0.1 | 0.7 | 11b3 | scraper | | | 1 |
| 14r1 | scraper | 2 | 2 | 100.0 | 14r1 | flake | 1 | 21.8 | 16.7 | 3.6 | 0.3 | 2.7 | 14r1 | flake | | | 1 |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **882** | | | | 51.6% | **882** | | | | | | | 7.2 | **882** | | 111 | 642 | 129 |
| | | | | | | | | | | | | | | Percentage | 12.6 | 72.8 | 14.6 |

**Table 16: Experimental Acheulean quartzite raw data.**
Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; vf – very fine grained; f – fine grained; m – medium grained; c – coarse grained; vc – very coarse grained; g – granules; N - no weathering; S – slight weathering; E – extensive weathering.

| Sn | Tt | Iscar | Dscar | % F | Sn | Tt | vf | f | m | c | vc | g | Sn | Tt | N | S | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10a3 | ach flake ret | 3 | 9 | 33.3 | 10a3 | ach flake ret | | | 1 | | | | 21b1 | chunk | | | 1 |
| 14h10 | casual core | 0 | 9 | 0.0 | 14h10 | casual core | | 1 | | | | | 21b3 | flake | | | 1 |
| 21L10 | cent core | 4 | 24 | 16.7 | 21L10 | cent core | | 1 | | | | | 21b5 | flake | | 1 | |
| 21c10 | chopper | 10 | 25 | 40.0 | 21c10 | chopper | | 1 | | | | | 21b6 | flake | | 1 | |
| 21f5 | chopper | 0 | 16 | 0.0 | 21f5 | chopper | | | 1 | | | | 21b7 | flake | | 1 | |
| 5idug10 | chopper | 11 | 24 | 45.8 | 5idug10 | chopper | | 1 | | | | | 21b8 | flake | | 1 | |
| 5Ldug3 | chopper | 2 | 11 | 18.2 | 5Ldug3 | chopper | | | 1 | | | | 21b9 | handaxe | | 1 | |
| 2a10 | chopper | 3 | 9 | 33.3 | 2a10 | chopper | | | | 1 | | | 21b10 | core, p | | 1 | |
| 14v5 | chopper | 1 | 7 | 14.3 | 14v5 | chopper | | | 1 | | | | 21c1 | flake | | 1 | |
| 10c5 | chopper | 9 | 30 | 30.0 | 10c5 | chopper | | | | 1 | | | 21c2 | flake | | 1 | |
| 14d5 | chopper | 5 | 19 | 26.3 | 14d5 | chopper | | 1 | | | | | 21c3 | retouch | | 1 | |
| 34c5 | chopper | 7 | 19 | 36.8 | 34c5 | chopper | | 1 | | | | | 21c4 | flake | | 1 | |
| 14f5 | chopper core | 9 | 23 | 39.1 | 14f5 | chopper core | | 1 | | | | | 21c5 | chunk | | 1 | |
| 32b10 | chopper core | 1 | 14 | 7.1 | 32b10 | chopper core | | 1 | | | | | 21c6 | flake | | 1 | |
| 21b1 | chunk | 0 | 5 | 0.0 | 21b1 | chunk | | | | 1 | | | 21c7 | chunk | | 1 | |
| 21c5 | chunk | 1 | 2 | 50.0 | 21c5 | chunk | | 1 | | | | | 21c8 | flake | | 1 | |
| 21c7 | chunk | 3 | 3 | 100.0 | 21c7 | chunk | | 1 | | | | | 21c10 | chopper | | 1 | |
| 21h2 | chunk | 1 | 6 | 16.7 | 21h2 | chunk | | 1 | | | | | 21f2 | flake | | 1 | |
| 14f1 | chunk | 4 | 9 | 44.4 | 14f1 | chunk | | 1 | | | | | 21f4 | flake | | 1 | |
| 32c4 | chunk | 3 | 4 | 75.0 | 32c4 | chunk | | | | | | 1 | 21f5 | chopper | | 1 | |
| 12a1 | chunk | 0 | 7 | 0.0 | 12a1 | chunk | | | | | 1 | | 21h1 | flake | | 1 | |
| 12a3 | chunk | 0 | 11 | 0.0 | 12a3 | chunk | | | | | 1 | | 21h2 | chunk | | 1 | |
| 12a4 | chunk | 0 | 6 | 0.0 | 12a4 | chunk | | | | | 1 | | 21h4 | flake | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5idug1 | chunk | 2 | 5 | 40.0 | 5idug1 | chunk | | 1 | | | | | 21h5 | core, p | | 1 | |
| 14s2 | chunk | 1 | 8 | 12.5 | 14s2 | chunk | | 1 | | | | | 21g1 | flake | | 1 | |
| 14s3 | chunk | 3 | 5 | 60.0 | 14s3 | chunk | | 1 | | | | | 21g2 | flake | 1 | | |
| 14j1 | chunk | 3 | 9 | 33.3 | 14j1 | chunk | | | 1 | | | | 21g3 | flake | | 1 | |
| 8L8 | chunk | 5 | 8 | 62.5 | 8L8 | chunk | | | 1 | | | | 21g4 | flake | 1 | | |
| 2a2 | chunk | 0 | 6 | 0.0 | 2a2 | chunk | | | | 1 | | | 21g6 | flake | 1 | | |
| 2a4 | chunk | 0 | 8 | 0.0 | 2a4 | chunk | | | | 1 | | | 21g8 | flake | | 1 | |
| 2a5 | chunk | 0 | 5 | 0.0 | 2a5 | chunk | | | | 1 | | | 21g9 | flake | | 1 | |
| 2a6 | chunk | 1 | 8 | 12.5 | 2a6 | chunk | | | | 1 | | | 21g10 | core, pi | | 1 | |
| 2a7 | chunk | 1 | 8 | 12.5 | 2a7 | chunk | | | | 1 | | | 21L1 | flake | 1 | | |
| 5ddug1 | chunk | 1 | 4 | 25.0 | 5ddug1 | chunk | | | | 1 | | | 21L2 | flake | 1 | | |
| 5ddug2 | chunk | 3 | 3 | 100.0 | 5ddug2 | chunk | | | | 1 | | | 21L3 | flake | 1 | | |
| 14c1 | chunk | 2 | 5 | 40.0 | 14c1 | chunk | | 1 | | | | | 21L4 | flake | | 1 | |
| 14c4 | chunk | 3 | 4 | 75.0 | 14c4 | chunk | | 1 | | | | | 21L5 | flake | 1 | | |
| 14c7 | chunk | 3 | 4 | 75.0 | 14c7 | chunk | | 1 | | | | | 21L6 | flake | 1 | | |
| 14n4 | chunk | 1 | 4 | 25.0 | 14n4 | chunk | | | 1 | | | | 21L7 | flake | | 1 | |
| 14n6 | chunk | 3 | 5 | 60.0 | 14n6 | chunk | | | 1 | | | | 21L9 | flake | 1 | | |
| 7a1 | chunk | 2 | 3 | 66.7 | 7a1 | chunk | | 1 | | | | | 21L10 | cent core | 1 | | |
| 14,O1 | chunk | 4 | 11 | 36.4 | 14,O1 | chunk | | 1 | | | | | 5bsurf1 | flake | 1 | | |
| 14,O2 | chunk | 4 | 4 | 100.0 | 14,O2 | chunk | | 1 | | | | | 5bsurf2 | flake | 1 | | |
| 8v2 | chunk | 2 | 2 | 100.0 | 8v2 | chunk | | 1 | | | | | 5bsurf3 | flake | 1 | | |
| 5mdug1 | chunk | 3 | 4 | 75.0 | 5mdug1 | chunk | | | 1 | | | | 5bsurf4 | flake | 1 | | |
| 14u3 | chunk | 4 | 4 | 100.0 | 14u3 | chunk | | | 1 | | | | 5bsurf7 | retouch | 1 | | |
| 10f2 | chunk | 3 | 6 | 50.0 | 10f2 | chunk | | 1 | | | | | 5bsurf8 | flake | 1 | | |
| 34c3 | chunk | 1 | 1 | 100.0 | 34c3 | chunk | | 1 | | | | | 5bsurf9 | flake | 1 | | |
| 5Odug5 | chunk | 4 | 4 | 100.0 | 5Odug5 | chunk | | | 1 | | | | 5bsurf10 | handaxe | 1 | | |
| 14c2 | chunk | 4 | 4 | 100.0 | 14c2 | chunk | | 1 | | | | | 8i1 | flake | | 1 | |
| 14t1 | chunk | 3 | 8 | 37.5 | 14t1 | chunk | | | 1 | | | | 8i2 | flake | | 1 | |
| 20t2 | chunk | 6 | 9 | 66.7 | 20t2 | chunk | | | | 1 | | | 8i3 | core, frag | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10u1 | chunk | 2 | 3 | 66.7 | 10u1 | chunk | | | 1 | | | | 8i5 | core, pi | | 1 | |
| 20ak1 | chunk | 3 | 5 | 60.0 | 20ak1 | chunk | | | 1 | | | | 14f1 | chunk | | 1 | |
| 6a1 | cleaver | 11 | 59 | 18.6 | 6a1 | cleaver | | 1 | | | | | 14f2 | flake | | 1 | |
| 5gsurf4 | cleaver | 2 | 37 | 5.4 | 5gsurf4 | cleaver | | 1 | | | | | 14f3 | retouch | | 1 | |
| 14j3 | cleaver / chopper | 10 | 17 | 58.8 | 14j3 | cleaver / chopper | | | 1 | | | | 14f5 | chopper core | | 1 | |
| 14c9 | core chunk | 8 | 8 | 100.0 | 14c9 | core chunk | | 1 | | | | | 32c1 | flake | | 1 | |
| 14c10 | core chunk | 13 | 16 | 81.3 | 14c10 | core chunk | | 1 | | | | | 32c2 | flake | | | 1 |
| 14h9 | core, cent | 0 | 20 | 0.0 | 14h9 | core, cent | | 1 | | | | | 32c3 | flake | | | 1 |
| 5gsurf3 | core, cent | 5 | 32 | 15.6 | 5gsurf3 | core, cent | | 1 | | | | | 32c4 | chunk | | | 1 |
| 33a4 | core, cent | 7 | 28 | 25.0 | 33a4 | core, cent | | | 1 | | | | 32c5 | flake | | | 1 |
| 20au3 | core, cent | 3 | 17 | 17.6 | 20au3 | core, cent | | | 1 | | | | 32c7 | flake | | | 1 |
| 10u3 | core, cent | 5 | 22 | 22.7 | 10u3 | core, cent | | | 1 | | | | 32c8 | flake | | | 1 |
| 6d4 | core, cent | 15 | 24 | 62.5 | 6d4 | core, cent | | | 1 | | | | 32c10 | core, p | | | 1 |
| 20ak5 | core, cent | 15 | 27 | 55.6 | 20ak5 | core, cent | | | 1 | | | | 12a1 | chunk | | | 1 |
| 14t3 | core, cent / chopper | 9 | 9 | 100.0 | 14t3 | core, cent / chopper | | | 1 | | | | 12a2 | flake | | | 1 |
| S10e4 | core, cent / handaxe | 1 | 31 | 3.2 | S10e4 | core, cent / handaxe | | | | 1 | | | 12a3 | chunk | | | 1 |
| 10a1 | core, disc/prep | 9 | 22 | 40.9 | 10a1 | core, disc/prep | | | 1 | | | | 12a4 | chunk | | | 1 |
| S8,O4 | core, flat | 1 | 27 | 3.7 | S8,O4 | core, flat | | | 1 | | | | 12a5 | flake | | | 1 |
| 32d2 | core, flat | 3 | 6 | 50.0 | 32d2 | core, flat | | 1 | | | | | 12a7 | flake | | | 1 |
| 10f5 | core, flat/p | 12 | 23 | 52.2 | 10f5 | core, flat/p | | 1 | | | | | 12a8 | flake | | | 1 |
| 31a3 | core, flat/prep | 11 | 20 | 55.0 | 31a3 | core, flat/prep | | 1 | | | | | 12a9 | core, frag | | | 1 |
| 8i3 | core, frag | 3 | 11 | 27.3 | 8i3 | core, frag | | | 1 | | | | 12a10 | core, pi | | | 1 |
| 12a9 | core, frag | 1 | 13 | 7.7 | 12a9 | core, frag | | | 1 | | | | 32b1 | flake | 1 | | |
| 5ddug4 | core, frag | 4 | 4 | 100.0 | 5ddug4 | core, frag | | | | 1 | | | 32b2 | flake | 1 | | |
| 5mdug4 | core, frag | 5 | 12 | 41.7 | 5mdug4 | core, frag | | | 1 | | | | 32b4 | flake | 1 | | |
| 20au2 | core, frag | 6 | 12 | 50.0 | 20au2 | core, frag | | | 1 | | | | 32b5 | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5pdug4 | core, frag | 9 | 15 | 60.0 | 5pdug4 | core, frag | | | 1 | | | | 32b8 | flake | 1 | | |
| 10f4 | core, frag | 6 | 12 | 50.0 | 10f4 | core, frag | | 1 | | | | | 32b9 | flake | 1 | | |
| 21b10 | core, p | 14 | 28 | 50.0 | 21b10 | core, p | | | | 1 | | | 32b10 | chopper core | 1 | | |
| 21h5 | core, p | 10 | 15 | 66.7 | 21h5 | core, p | | 1 | | | | | 5idug1 | chunk | | 1 | |
| 32c10 | core, p | 3 | 19 | 15.8 | 32c10 | core, p | | | | | | 1 | 5idug2 | flake | | 1 | |
| 11d9 | core, p | 3 | 19 | 15.8 | 11d9 | core, p | | | | 1 | | | 5idug3 | flake | | 1 | |
| 11d10 | core, p | 5 | 22 | 22.7 | 11d10 | core, p | | | | 1 | | | 5idug4 | flake | | 1 | |
| 8L10 | core, p | 6 | 26 | 23.1 | 8L10 | core, p | | | 1 | | | | 5idug6 | flake | | 1 | |
| 6a3 | core, p | 17 | 33 | 51.5 | 6a3 | core, p | | 1 | | | | | 5idug7 | flake | | 1 | |
| 5fsurf2 | core, p | 12 | 23 | 52.2 | 5fsurf2 | core, p | | 1 | | | | | 5idug8 | flake | | 1 | |
| 20aj2 | core, p | 10 | 34 | 29.4 | 20aj2 | core, p | | 1 | | | | | 5idug9 | flake | | 1 | |
| 8v4 | core, p | 20 | 24 | 83.3 | 8v4 | core, p | | 1 | | | | | 5idug10 | chopper | | 1 | |
| 8n2 | core, p | 5 | 21 | 23.8 | 8n2 | core, p | | | 1 | | | | 11d1 | flake | | | 1 |
| 8n5 | core, p | 9 | 22 | 40.9 | 8n5 | core, p | | | 1 | | | | 11d2 | flake | | | 1 |
| 5asurf9 | core, p | 7 | 41 | 17.1 | 5asurf9 | core, p | | | 1 | | | | 11d3 | flake | | | 1 |
| 5esurf3 | core, p | 7 | 13 | 53.8 | 5esurf3 | core, p | | | | 1 | | | 11d4 | flake | | | 1 |
| 5dsurf4 | core, p | 7 | 22 | 31.8 | 5dsurf4 | core, p | | | | 1 | | | 11d5 | flake | | | 1 |
| 5qdug3 | core, p | 5 | 33 | 15.2 | 5qdug3 | core, p | | | 1 | | | | 11d6 | flake | | | 1 |
| 5Odug8 | core, p | 15 | 16 | 93.8 | 5Odug8 | core, p | | | 1 | | | | 11d8 | flake | | | 1 |
| 21g10 | core, pi | 14 | 32 | 43.8 | 21g10 | core, pi | | 1 | | | | | 11d9 | core, p | | | 1 |
| 8i5 | core, pi | 6 | 15 | 40.0 | 8i5 | core, pi | | | 1 | | | | 11d10 | core, p | | | 1 |
| 12a10 | core, pi | 1 | 16 | 6.3 | 12a10 | core, pi | | | | 1 | | | 5r2 | flake | | | 1 |
| 5r3 | core, pi | 4 | 15 | 26.7 | 5r3 | core, pi | | 1 | | | | | 5r3 | core, pi | | | 1 |
| 5Ldug2 | core, pi | 1 | 24 | 4.2 | 5Ldug2 | core, pi | | | 1 | | | | 14s1 | flake | | | 1 |
| 8L9 | core, pi | 1 | 15 | 6.7 | 8L9 | core, pi | | | 1 | | | | 14s2 | chunk | | | 1 |
| 5ddug5 | core, pi | 8 | 8 | 100.0 | 5ddug5 | core, pi | | | | 1 | | | 14s3 | chunk | | | 1 |
| S10,O10 | core, pi | 12 | 24 | 50.0 | S10,O10 | core, pi | | 1 | | | | | 14j1 | chunk | | | 1 |
| 14n10 | core, pi | 9 | 18 | 50.0 | 14n10 | core, pi | | | 1 | | | | 14j2 | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7a3 | core, pi | 8 | 15 | 53.3 | 7a3 | core, pi | | 1 | | | | | 14j3 | cleaver / chopper | | | 1 |
| 14,O3 | core, pi | 6 | 7 | 85.7 | 14,O3 | core, pi | | 1 | | | | | 5Ldug1 | flake | | | 1 |
| 14w3 | core, pi | 0 | 11 | 0.0 | 14w3 | core, pi | | | 1 | | | | 5Ldug2 | core, pi | | | 1 |
| 14q3 | core, pi | 2 | 5 | 40.0 | 14q3 | core, pi | | 1 | | | | | 5Ldug3 | chopper | | | 1 |
| 10c4 | core, pi | 5 | 22 | 22.7 | 10c4 | core, pi | | | | 1 | | | 8L1 | flake | | 1 | |
| 14u5 | core, pi | 10 | 13 | 76.9 | 14u5 | core, pi | | | 1 | | | | 8L2 | flake | | 1 | |
| 5jsurf3 | denticulate | 8 | 11 | 72.7 | 5jsurf3 | denticulate | | | 1 | | | | 8L6 | flake | | 1 | |
| 8m3 | denticulate | 6 | 12 | 50.0 | 8m3 | denticulate | | | 1 | | | | 8L7 | flake | | 1 | |
| 10c2 | denticulate | 2 | 21 | 9.5 | 10c2 | denticulate | | | | 1 | | | 8L8 | chunk | | 1 | |
| 21b3 | flake | 3 | 7 | 42.9 | 21b3 | flake | | | | 1 | | | 8L9 | core, pi | | 1 | |
| 21b5 | flake | 7 | 9 | 77.8 | 21b5 | flake | | | | 1 | | | 8L10 | core, p | | 1 | |
| 21b6 | flake | 9 | 10 | 90.0 | 21b6 | flake | | | | 1 | | | 2a1 | flake | | | 1 |
| 21b7 | flake | 5 | 8 | 62.5 | 21b7 | flake | | | | 1 | | | 2a2 | chunk | | | 1 |
| 21b8 | flake | 1 | 1 | 100.0 | 21b8 | flake | | | | 1 | | | 2a3 | flake | | | 1 |
| 21c1 | flake | 0 | 5 | 0.0 | 21c1 | flake | | 1 | | | | | 2a4 | chunk | | | 1 |
| 21c2 | flake | 2 | 5 | 40.0 | 21c2 | flake | | 1 | | | | | 2a5 | chunk | | | 1 |
| 21c4 | flake | 0 | 2 | 0.0 | 21c4 | flake | | 1 | | | | | 2a6 | chunk | | | 1 |
| 21c6 | flake | 1 | 1 | 100.0 | 21c6 | flake | | 1 | | | | | 2a7 | chunk | | | 1 |
| 21c8 | flake | 0 | 1 | 0 | 21c8 | flake | | 1 | | | | | 2a8 | flake | | | 1 |
| 21f2 | flake | 1 | 10 | 10.0 | 21f2 | flake | | | 1 | | | | 2a9 | flake | | | 1 |
| 21f4 | flake | 1 | 1 | 100.0 | 21f4 | flake | | | 1 | | | | 2a10 | chopper | | | 1 |
| 21h1 | flake | 2 | 5 | 40 | 21h1 | flake | | 1 | | | | | 14h1 | flake | | | 1 |
| 21h4 | flake | 4 | 6 | 66.7 | 21h4 | flake | | 1 | | | | | 14h2 | flake | | | 1 |
| 21g1 | flake | 1 | 4 | 25.0 | 21g1 | flake | | 1 | | | | | 14h3 | flake | | | 1 |
| 21g2 | flake | 4 | 5 | 80.0 | 21g2 | flake | | 1 | | | | | 14h4 | flake | | | 1 |
| 21g3 | flake | 2 | 2 | 100.0 | 21g3 | flake | | 1 | | | | | 14h5 | flake | | | 1 |
| 21g4 | flake | 1 | 2 | 50.0 | 21g4 | flake | | 1 | | | | | 14h6 | flake | | | 1 |
| 21g6 | flake | 3 | 8 | 37.5 | 21g6 | flake | | 1 | | | | | 14h7 | flake | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21g8 | flake | 0 | 2 | 0.0 | 21g8 | flake | | 1 | | | | | 14h8 | retouch | | | 1 |
| 21g9 | flake | 4 | 5 | 80.0 | 21g9 | flake | | 1 | | | | | 14h9 | core, cent | | | 1 |
| 21L1 | flake | 0 | 8 | 0.0 | 21L1 | flake | | 1 | | | | | 14h10 | casual core | | | 1 |
| 21L2 | flake | 0 | 3 | 0.0 | 21L2 | flake | | 1 | | | | | 5ddug1 | chunk | | | 1 |
| 21L3 | flake | 1 | 3 | 33.3 | 21L3 | flake | | 1 | | | | | 5ddug2 | chunk | | | 1 |
| 21L4 | flake | 0 | 1 | 0.0 | 21L4 | flake | | 1 | | | | | 5ddug4 | core, frag | | | 1 |
| 21L5 | flake | 0 | 7 | 0.0 | 21L5 | flake | | 1 | | | | | 5ddug5 | core, pi | | | 1 |
| 21L6 | flake | 0 | 6 | 0.0 | 21L6 | flake | | 1 | | | | | 14v1 | flake | | 1 | |
| 21L7 | flake | 0 | 1 | 0.0 | 21L7 | flake | | 1 | | | | | 14v2 | flake | | 1 | |
| 21L9 | flake | 0 | 4 | 0.0 | 21L9 | flake | | 1 | | | | | 14v3 | flake | | 1 | |
| 5bsurf1 | flake | 0 | 8 | 0.0 | 5bsurf1 | flake | | 1 | | | | | 14v4 | flake | | 1 | |
| 5bsurf2 | flake | 0 | 8 | 0.0 | 5bsurf2 | flake | | 1 | | | | | 14v5 | chopper | | 1 | |
| 5bsurf3 | flake | 4 | 7 | 57.1 | 5bsurf3 | flake | | 1 | | | | | 6a1 | cleaver | | 1 | |
| 5bsurf4 | flake | 2 | 10 | 20.0 | 5bsurf4 | flake | | 1 | | | | | 6a2 | handaxe | | 1 | |
| 5bsurf8 | flake | 0 | 18 | 0.0 | 5bsurf8 | flake | | 1 | | | | | 6a3 | core, p | | 1 | |
| 5bsurf9 | flake | 4 | 18 | 22.2 | 5bsurf9 | flake | | 1 | | | | | 5fsurf2 | core, p | | 1 | |
| 8i1 | flake | 2 | 10 | 20.0 | 8i1 | flake | | | 1 | | | | 5fsurf3 | pick | | 1 | |
| 8i2 | flake | 1 | 1 | 100.0 | 8i2 | flake | | | 1 | | | | 20aj2 | core, p | | 1 | |
| 14f2 | flake | 4 | 4 | 100.0 | 14f2 | flake | | 1 | | | | | 10d2 | handaxe | | 1 | |
| 32c1 | flake | 0 | 3 | 0.0 | 32c1 | flake | | | | | | 1 | S10,O1 | flake | | 1 | |
| 32c2 | flake | 1 | 7 | 14.3 | 32c2 | flake | | | | | | 1 | S10,O2 | flake | | 1 | |
| 32c3 | flake | 0 | 3 | 0.0 | 32c3 | flake | | | | | | 1 | S10,O3 | flake | | 1 | |
| 32c5 | flake | 1 | 7 | 14.3 | 32c5 | flake | | | | | | 1 | S10,O4 | flake | | 1 | |
| 32c7 | flake | 1 | 8 | 12.5 | 32c7 | flake | | | | | | 1 | S10,O5 | flake | | 1 | |
| 32c8 | flake | 3 | 5 | 60.0 | 32c8 | flake | | | | | | 1 | S10,O6 | flake | 1 | | |
| 12a2 | flake | 1 | 4 | 25.0 | 12a2 | flake | | | | | 1 | | S10,O7 | flake | | 1 | |
| 12a5 | flake | 0 | 5 | 0.0 | 12a5 | flake | | | 1 | | | | S10,O8 | flake | | 1 | |
| 12a7 | flake | 0 | 4 | 0.0 | 12a7 | flake | | | | | 1 | | S10,O10 | core, pi | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12a8 | flake | 1 | 8 | 12.5 | 12a8 | flake | | | | | 1 | | 14c1 | chunk | | 1 | |
| 32b1 | flake | 4 | 5 | 80.0 | 32b1 | flake | | 1 | | | | | 14c2 | flake | | 1 | |
| 32b2 | flake | 0 | 7 | 0.0 | 32b2 | flake | | 1 | | | | | 14c3 | flake | | 1 | |
| 32b4 | flake | 0 | 3 | 0.0 | 32b4 | flake | | 1 | | | | | 14c4 | chunk | | 1 | |
| 32b5 | flake | 1 | 6 | 16.7 | 32b5 | flake | | 1 | | | | | 14c5 | flake | | 1 | |
| 32b8 | flake | 6 | 8 | 75.0 | 32b8 | flake | | 1 | | | | | 14c7 | chunk | | 1 | |
| 32b9 | flake | 3 | 5 | 60.0 | 32b9 | flake | | 1 | | | | | 14c9 | core chunk | | 1 | |
| 5idug2 | flake | 6 | 9 | 66.7 | 5idug2 | flake | | 1 | | | | | 14c10 | core chunk | | 1 | |
| 5idug3 | flake | 1 | 5 | 20.0 | 5idug3 | flake | | 1 | | | | | 5gsurf3 | core, cent | 1 | | |
| 5idug4 | flake | 0 | 4 | 0.0 | 5idug4 | flake | | 1 | | | | | 5gsurf4 | cleaver | | 1 | |
| 5idug6 | flake | 4 | 5 | 80.0 | 5idug6 | flake | | 1 | | | | | 31a2 | flake | | 1 | |
| 5idug7 | flake | 3 | 4 | 75.0 | 5idug7 | flake | | 1 | | | | | 31a3 | core, flat/prep | | 1 | |
| 5idug8 | flake | 2 | 2 | 100.0 | 5idug8 | flake | | 1 | | | | | 10a1 | core, disc/prep | | 1 | |
| 5idug9 | flake | 3 | 3 | 100.0 | 5idug9 | flake | | 1 | | | | | 10a3 | ach flake ret | | 1 | |
| 11d1 | flake | 1 | 4 | 25.0 | 11d1 | flake | | | | 1 | | | 10a4 | handaxe | | 1 | |
| 11d2 | flake | 0 | 6 | 0.0 | 11d2 | flake | | | | 1 | | | 14n1 | flake | | | 1 |
| 11d3 | flake | 1 | 6 | 16.7 | 11d3 | flake | | | | 1 | | | 14n2 | flake | | | 1 |
| 11d4 | flake | 0 | 4 | 0.0 | 11d4 | flake | | | | 1 | | | 14n3 | flake | | | 1 |
| 11d5 | flake | 0 | 4 | 0.0 | 11d5 | flake | | | | 1 | | | 14n4 | chunk | | | 1 |
| 11d6 | flake | 1 | 5 | 20.0 | 11d6 | flake | | | | 1 | | | 14n5 | flake | | | 1 |
| 11d8 | flake | 0 | 10 | 0.0 | 11d8 | flake | | | | 1 | | | 14n6 | chunk | | | 1 |
| 5r2 | flake | 0 | 9 | 0.0 | 5r2 | flake | | 1 | | | | | 14n7 | flake | | | 1 |
| 14s1 | flake | 1 | 4 | 25.0 | 14s1 | flake | | 1 | | | | | 14n8 | flake | | | 1 |
| 14j2 | flake | 1 | 2 | 50.0 | 14j2 | flake | | | 1 | | | | 14n9 | flake | | | 1 |
| 5Ldug1 | flake | 1 | 3 | 33.3 | 5Ldug1 | flake | | | 1 | | | | 14n10 | core, pi | | | 1 |
| 8L1 | flake | 0 | 4 | 0.0 | 8L1 | flake | | | 1 | | | | 7a1 | chunk | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8L2 | flake | 0 | 9 | 0.0 | 8L2 | flake | | | 1 | | | | 7a3 | core, pi | | 1 | |
| 8L6 | flake | 0 | 9 | 0.0 | 8L6 | flake | | | 1 | | | | 14,O1 | chunk | | 1 | |
| 8L7 | flake | 4 | 10 | 40.0 | 8L7 | flake | | | 1 | | | | 14,O2 | chunk | | 1 | |
| 2a1 | flake | 0 | 3 | 0.0 | 2a1 | flake | | | | 1 | | | 14,O3 | core, pi | | 1 | |
| 2a3 | flake | 0 | 6 | 0.0 | 2a3 | flake | | | | 1 | | | 8v1 | flake | | 1 | |
| 2a8 | flake | 0 | 10 | 0.0 | 2a8 | flake | | | | 1 | | | 8v2 | chunk | | 1 | |
| 2a9 | flake | 1 | 4 | 25.0 | 2a9 | flake | | | | 1 | | | 8v4 | core, p | | 1 | |
| 14h1 | flake | 0 | 3 | 0.0 | 14h1 | flake | | 1 | | | | | 33a1 | flake | | 1 | |
| 14h2 | flake | 0 | 4 | 0.0 | 14h2 | flake | | 1 | | | | | 33a3 | flake | | 1 | |
| 14h3 | flake | 1 | 5 | 20.0 | 14h3 | flake | | 1 | | | | | 33a4 | core, cent | | 1 | |
| 14h4 | flake | 0 | 3 | 0.0 | 14h4 | flake | | 1 | | | | | 5mdug1 | chunk | | 1 | |
| 14h5 | flake | 0 | 3 | 0.0 | 14h5 | flake | | 1 | | | | | 5mdug2 | flake | | 1 | |
| 14h6 | flake | 0 | 5 | 0.0 | 14h6 | flake | | 1 | | | | | 5mdug4 | core, frag | | 1 | |
| 14h7 | flake | 0 | 2 | 0.0 | 14h7 | flake | | 1 | | | | | 5jsurf2 | flake | | 1 | |
| 14v1 | flake | 1 | 8 | 12.5 | 14v1 | flake | | | 1 | | | | 5jsurf3 | denticulate | | 1 | |
| 14v2 | flake | 0 | 1 | 0.0 | 14v2 | flake | | | 1 | | | | 20au1 | flake | | | 1 |
| 14v3 | flake | 1 | 8 | 12.5 | 14v3 | flake | | | 1 | | | | 20au2 | core, frag | | | 1 |
| 14v4 | flake | 1 | 1 | 100.0 | 14v4 | flake | | | 1 | | | | 20au3 | core, cent | | | 1 |
| S10,O1 | flake | 2 | 4 | 50.0 | S10,O1 | flake | | 1 | | | | | 14w1 | flake | | | 1 |
| S10,O2 | flake | 5 | 9 | 55.6 | S10,O2 | flake | | 1 | | | | | 14w2 | flake | | | 1 |
| S10,O3 | flake | 4 | 7 | 57.1 | S10,O3 | flake | | 1 | | | | | 14w3 | core, pi | | | 1 |
| S10,O4 | flake | 1 | 2 | 50.0 | S10,O4 | flake | | 1 | | | | | 14q1 | flake | | 1 | |
| S10,O5 | flake | 5 | 6 | 83.3 | S10,O5 | flake | | 1 | | | | | 14q2 | flake | | 1 | |
| S10,O6 | flake | 3 | 7 | 42.9 | S10,O6 | flake | | 1 | | | | | 14q3 | core, pi | | 1 | |
| S10,O7 | flake | 2 | 2 | 100.0 | S10,O7 | flake | | 1 | | | | | 8m1 | flake | | 1 | |
| S10,O8 | flake | 1 | 1 | 100.0 | S10,O8 | flake | | 1 | | | | | 8m3 | denticulate | | 1 | |
| 14c2 | flake | 1 | 2 | 50.0 | 14c2 | flake | | 1 | | | | | 8m4 | flake | | 1 | |
| 14c3 | flake | 6 | 6 | 100.0 | 14c3 | flake | | 1 | | | | | 8m5 | flake | | 1 | |
| 14c5 | flake | 6 | 7 | 85.7 | 14c5 | flake | | 1 | | | | | 8n2 | core, p | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31a2 | flake | 5 | 5 | 100.0 | 31a2 | flake | | 1 | | | | | 8n4 | handaxe | | 1 | |
| 14n1 | flake | 1 | 6 | 16.7 | 14n1 | flake | | | 1 | | | | 8n5 | core, p | | 1 | |
| 14n2 | flake | 1 | 4 | 25.0 | 14n2 | flake | | | 1 | | | | 5asurf2 | flake | | 1 | |
| 14n3 | flake | 1 | 2 | 50.0 | 14n3 | flake | | | 1 | | | | 5asurf3 | flake | 1 | | |
| 14n5 | flake | 1 | 4 | 25.0 | 14n5 | flake | | | 1 | | | | 5asurf4 | flake | | 1 | |
| 14n7 | flake | 2 | 3 | 66.7 | 14n7 | flake | | | 1 | | | | 5asurf5 | flake | | 1 | |
| 14n8 | flake | 3 | 8 | 37.5 | 14n8 | flake | | | 1 | | | | 5asurf6 | flake | 1 | | |
| 14n9 | flake | 5 | 8 | 62.5 | 14n9 | flake | | | 1 | | | | 5asurf8 | flake | | 1 | |
| 8v1 | flake | 6 | 7 | 85.7 | 8v1 | flake | | 1 | | | | | 5asurf9 | core, p | | 1 | |
| 33a1 | flake | 0 | 6 | 0.0 | 33a1 | flake | | | 1 | | | | 5asurf10 | handaxe | | 1 | |
| 33a3 | flake | 0 | 5 | 0.0 | 33a3 | flake | | | 1 | | | | 5esurf1 | flake | | | 1 |
| 5mdug2 | flake | 1 | 4 | 25.0 | 5mdug2 | flake | | | 1 | | | | 5esurf2 | flake | | | 1 |
| 5jsurf2 | flake | 2 | 3 | 66.7 | 5jsurf2 | flake | | | 1 | | | | 5esurf3 | core, p | | | 1 |
| 20au1 | flake | 2 | 4 | 50.0 | 20au1 | flake | | | 1 | | | | 14p1 | flake | | | 1 |
| 14w1 | flake | 1 | 4 | 25.0 | 14w1 | flake | | | 1 | | | | 14p2 | flake | | | 1 |
| 14w2 | flake | 0 | 3 | 0.0 | 14w2 | flake | | | 1 | | | | 5dsurf1 | flake | | | 1 |
| 14q1 | flake | 2 | 6 | 33.3 | 14q1 | flake | | 1 | | | | | 5dsurf3 | handaxe | | | 1 |
| 14q2 | flake | 1 | 5 | 20.0 | 14q2 | flake | | 1 | | | | | 5dsurf4 | core, p | | | 1 |
| 8m1 | flake | 0 | 4 | 0.0 | 8m1 | flake | | | 1 | | | | 10c2 | denticulate | 1 | | |
| 8m4 | flake | 6 | 9 | 66.7 | 8m4 | flake | | | 1 | | | | 10c3 | flake | 1 | | |
| 8m5 | flake | 3 | 4 | 75.0 | 8m5 | flake | | | 1 | | | | 10c4 | core, pi | | 1 | |
| 5asurf2 | flake | 0 | 10 | 0.0 | 5asurf2 | flake | | | 1 | | | | 10c5 | chopper | | 1 | |
| 5asurf3 | flake | 2 | 8 | 25.0 | 5asurf3 | flake | | | 1 | | | | S8,O1 | flake | 1 | | |
| 5asurf4 | flake | 0 | 10 | 0.0 | 5asurf4 | flake | | | 1 | | | | S8,O3 | flake | | 1 | |
| 5asurf5 | flake | 2 | 7 | 28.6 | 5asurf5 | flake | | | 1 | | | | S8,O4 | core, flat | | 1 | |
| 5asurf6 | flake | 0 | 12 | 0.0 | 5asurf6 | flake | | | 1 | | | | S8,O5 | handaxe | | 1 | |
| 5asurf8 | flake | 3 | 8 | 37.5 | 5asurf8 | flake | | | 1 | | | | 14u1 | flake | | | 1 |
| 5esurf1 | flake | 2 | 5 | 40.0 | 5esurf1 | flake | | | | 1 | | | 14u2 | flake | | | 1 |
| 5esurf2 | flake | 4 | 5 | 80.0 | 5esurf2 | flake | | | | 1 | | | 14u3 | chunk | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14p1 | flake | 3 | 5 | 60.0 | 14p1 | flake | | | | 1 | | | 14u4 | flake | | | 1 |
| 14p2 | flake | 1 | 1 | 100.0 | 14p2 | flake | | | | 1 | | | 14u5 | core, pi | | | 1 |
| 5dsurf1 | flake | 2 | 5 | 40.0 | 5dsurf1 | flake | | | | 1 | | | 5pdug1 | flake | | | 1 |
| 10c3 | flake | 4 | 13 | 30.8 | 10c3 | flake | | | | 1 | | | 5pdug4 | core, frag | | | 1 |
| S8,O1 | flake | 0 | 8 | 0.0 | S8,O1 | flake | | | 1 | | | | 5pdug5 | handaxe | | | 1 |
| S8,O3 | flake | 2 | 5 | 40.0 | S8,O3 | flake | | | 1 | | | | 5qdug3 | core, p | | 1 | |
| 14u1 | flake | 0 | 1 | 0.0 | 14u1 | flake | | | 1 | | | | 5qdug5 | pick | | 1 | |
| 14u2 | flake | 1 | 2 | 50.0 | 14u2 | flake | | | 1 | | | | 14d1 | flake | | 1 | |
| 14u4 | flake | 2 | 2 | 100.0 | 14u4 | flake | | | 1 | | | | 14d3 | flake | | 1 | |
| 5pdug1 | flake | 1 | 4 | 25.0 | 5pdug1 | flake | | 1 | | | | | 14d4 | handaxe | | 1 | |
| 14d1 | flake | 5 | 8 | 62.5 | 14d1 | flake | | 1 | | | | | 14d5 | chopper | | 1 | |
| 14d3 | flake | 4 | 5 | 80.0 | 14d3 | flake | | 1 | | | | | 10f1 | flake | | 1 | |
| 10f1 | flake | 4 | 4 | 100.0 | 10f1 | flake | | 1 | | | | | 10f2 | chunk | | 1 | |
| 34c1 | flake | 1 | 2 | 50.0 | 34c1 | flake | | 1 | | | | | 10f4 | core, frag | | 1 | |
| 34c2 | flake | 0 | 4 | 0.0 | 34c2 | flake | | 1 | | | | | 10f5 | core, flat/p | | 1 | |
| 5Odug1 | flake | 6 | 6 | 100.0 | 5Odug1 | flake | | | 1 | | | | 34c1 | flake | | 1 | |
| 5Odug2 | flake | 2 | 2 | 100.0 | 5Odug2 | flake | | | 1 | | | | 34c2 | flake | | 1 | |
| 5Odug3 | flake | 4 | 4 | 100.0 | 5Odug3 | flake | | | 1 | | | | 34c3 | chunk | | 1 | |
| 5Odug4 | flake | 7 | 7 | 100.0 | 5Odug4 | flake | | | 1 | | | | 34c5 | chopper | | 1 | |
| 5Odug7 | flake | 3 | 3 | 100.0 | 5Odug7 | flake | | | 1 | | | | 5Odug1 | flake | | | 1 |
| 5Odug9 | flake | 9 | 10 | 90.0 | 5Odug9 | flake | | | 1 | | | | 5Odug2 | flake | | | 1 |
| 5Odug10 | flake | 1 | 1 | 100.0 | 5Odug10 | flake | | | 1 | | | | 5Odug3 | flake | | | 1 |
| 14c1 | flake | 1 | 4 | 25.0 | 14c1 | flake | | 1 | | | | | 5Odug4 | flake | | | 1 |
| 14c3 | flake | 1 | 2 | 50.0 | 14c3 | flake | | 1 | | | | | 5Odug5 | chunk | | | 1 |
| 32d1 | flake | 1 | 2 | 50.0 | 32d1 | flake | | 1 | | | | | 5Odug7 | flake | | | 1 |
| 14t2 | flake | 1 | 1 | 100.0 | 14t2 | flake | | | 1 | | | | 5Odug8 | core, p | | | 1 |
| S10e1 | flake | 1 | 3 | 33.3 | S10e1 | flake | | | 1 | | | | 5Odug9 | flake | | | 1 |
| S10e2 | flake | 1 | 7 | 14.3 | S10e2 | flake | | | | 1 | | | 5Odug10 | flake | | | 1 |
| 20t1 | flake | 3 | 4 | 75.0 | 20t1 | flake | | | | 1 | | | 14c1 | flake | | | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6d1 | flake | 2 | 3 | 66.7 | 6d1 | flake | | | 1 | | | | 14c2 | chunk | | | 1 |
| 6d2 | flake | 3 | 3 | 100.0 | 6d2 | flake | | | 1 | | | | 14c3 | flake | | | 1 |
| 20ak2 | flake | 6 | 10 | 60.0 | 20ak2 | flake | | | 1 | | | | 14c4 | handaxe | | | 1 |
| 20ak3 | flake | 4 | 5 | 80.0 | 20ak3 | flake | | | 1 | | | | 32d1 | flake | | | 1 |
| 21b9 | handaxe | 8 | 17 | 47.1 | 21b9 | handaxe | | | | 1 | | | 32d2 | core, flat | | | 1 |
| 5bsurf10 | handaxe | 9 | 56 | 16.1 | 5bsurf10 | handaxe | | 1 | | | | | 14t1 | chunk | | | 1 |
| 6a2 | handaxe | 24 | 66 | 36.4 | 6a2 | handaxe | | 1 | | | | | 14t2 | flake | | | 1 |
| 10d2 | handaxe | 25 | 53 | 47.2 | 10d2 | handaxe | | | 1 | | | | 14t3 | core, cent / chopper | | | 1 |
| 10a4 | handaxe | 20 | 67 | 29.9 | 10a4 | handaxe | | | 1 | | | | S10e1 | flake | | 1 | |
| 5asurf10 | handaxe | 10 | 31 | 32.3 | 8n4 | handaxe | | | 1 | | | | S10e2 | flake | | 1 | |
| 5dsurf3 | handaxe | 11 | 27 | 40.7 | 5asurf10 | handaxe | | | 1 | | | | S10e4 | core, cent / handaxe | | 1 | |
| S8,O5 | handaxe | 8 | 37 | 21.6 | 5dsurf3 | handaxe | | | 1 | | | | 20t1 | flake | | 1 | |
| 5pdug5 | handaxe | 8 | 16 | 50.0 | S8,O5 | handaxe | | | 1 | | | | 20t2 | chunk | | 1 | |
| 14d4 | handaxe | 12 | 33 | 36.4 | 5pdug5 | handaxe | | 1 | | | | | 10u1 | chunk | | 1 | |
| 14c4 | handaxe | 9 | 24 | 37.5 | 14d4 | handaxe | | 1 | | | | | 10u3 | core, cent | | 1 | |
| 6d5 | handaxe | 20 | 26 | 76.9 | 14c4 | handaxe | | 1 | | | | | 6d1 | flake | | 1 | |
| 8n4 | handaxe, tip | 7 | 18 | 38.9 | 6d5 | handaxe | | | 1 | | | | 6d2 | flake | | 1 | |
| 5fsurf3 | pick | 25 | 34 | 73.5 | 5fsurf3 | pick | | 1 | | | | | 6d4 | core, cent | | 1 | |
| 5qdug5 | pick | 19 | 32 | 59.4 | 5qdug5 | pick | | | 1 | | | | 6d5 | handaxe | | 1 | |
| 21c3 | retouch | 1 | 4 | 25 | 21c3 | retouch | | 1 | | | | | 20ak1 | chunk | | 1 | |
| 5bsurf7 | retouch | 0 | 14 | 0.0 | 5bsurf7 | retouch | | 1 | | | | | 20ak2 | flake | | 1 | |
| 14f3 | retouch | 0 | 12 | 0.0 | 14f3 | retouch | | 1 | | | | | 20ak3 | flake | | 1 | |
| 14h8 | retouch | 0 | 9 | 0.0 | 14h8 | retouch | | 1 | | | | | 20ak5 | core, cent | | 1 | |
| 33a2 | retouch | 0 | 14 | 0.0 | 33a2 | retouch | | | 1 | | | | 33a2 | retouch | | 1 | |
| 5r1 | retouch | 1 | 9 | 11.1 | 5r1 | retouch | | 1 | | | | | 5r1 | retouch | | | 1 |
| 8v3 | retouch | 7 | 16 | 43.8 | 8v3 | retouch | | 1 | | | | | 8v3 | retouch | | 1 | |
| 8i4 | retouch | 8 | 18 | 44.4 | 8i4 | retouch | | | 1 | | | | 8i4 | retouch | | 1 | |
| 34c4 | retouch | 3 | 18 | 16.7 | 34c4 | retouch | | 1 | | | | | 34c4 | retouch | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **n** | | | | **Mean** | **n** | | | | | | | | **n** | | | | |
| **303** | | | | 40.2% | **303** | | 0 | 134 | 108 | 47 | 6 | 8 | **303** | | 32 | 158 | 113 |
| | | | | | | Percentage of sample | 0.0 | 44.2 | 35.6 | 15.5 | 2.0 | 2.6 | | Percentage of sample | 10.6 | 52.1 | 37.3 |

**Table 17: Experimental Acheulean quartz raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| Sn | Tt | Iscar | Dscar | % F | Sn | Tt | f | L, mm | w, mm | a cm2 | f/cm2 | f/10 cm2 | Sn | Tt | N | S | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S15e1 | chunk | 4 | 5 | 80.0 | S15e1 | chunk | 2 | 27.5 | 19 | 5.2 | 0.4 | 3.8 | S15e1 | chunk | | 1 | |
| S15e2 | flake | 2 | 9 | 22.2 | S15e2 | flake | 1 | 35 | 30.7 | 10.7 | 0.1 | 0.9 | S15e2 | flake | 1 | | |
| S15e3 | flake | 2 | 3 | 66.7 | S15e3 | flake | 4 | 54.3 | 41 | 22.3 | 0.2 | 1.8 | S15e3 | flake | 1 | | |
| 15f1 | core, c | 8 | 16 | 50.0 | 15f1 | core, c | 3 | 19.6 | 10.4 | 2.0 | 1.5 | 14.7 | 15f1 | core, c | | 1 | |
| 15f2 | flake | 5 | 8 | 62.5 | 15f2 | flake | 5 | 34.7 | 22 | 7.6 | 0.7 | 6.5 | 15f2 | flake | | 1 | |
| 15f4 | chunk | 8 | 8 | 100.0 | 15f4 | chunk | 18 | 28 | 23.8 | 6.7 | 2.7 | 27.0 | 15f4 | chunk | | | 1 |
| 15f5 | core, p | 24 | 29 | 82.8 | 15f5 | core, p | 10 | 62.8 | 60.7 | 38.1 | 0.3 | 2.6 | 15f5 | core, p | | 1 | |
| 15L1 | chunk | 1 | 3 | 33.3 | 15L1 | chunk | 3 | 15 | 11.6 | 1.7 | 1.7 | 17.2 | 15L1 | chunk | 1 | | |
| 15L2 | flake | 1 | 4 | 25.0 | 15L2 | flake | 2 | 21.5 | 10 | 2.2 | 0.9 | 9.3 | 15L2 | flake | 1 | | |
| 15L3 | flake | 0 | 8 | 0.0 | 15L3 | flake | 7 | 23.6 | 12.6 | 3.0 | 2.4 | 23.5 | 15L3 | flake | 1 | | |
| 15L4 | flake | 2 | 4 | 50.0 | 15L4 | flake | 2 | 22.2 | 12.2 | 2.7 | 0.7 | 7.4 | 15L4 | flake | 1 | | |
| 15L5 | flake | 0 | 4 | 0.0 | 15L5 | flake | 2 | 21.2 | 19 | 4.0 | 0.5 | 5.0 | 15L5 | flake | 1 | | |
| 15L6 | flake | 1 | 3 | 33.3 | 15L6 | flake | 3 | 25 | 23.4 | 5.9 | 0.5 | 5.1 | 15L6 | flake | 1 | | |
| 15L9 | flake | 6 | 13 | 46.2 | 15L9 | flake | 5 | 43.5 | 31.7 | 13.8 | 0.4 | 3.6 | 15L9 | flake | 1 | | |
| 15p1 | chunk | 1 | 3 | 33.3 | 15p1 | chunk | 1 | 18 | 8.3 | 1.5 | 0.7 | 6.7 | 15p1 | chunk | 1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15p2 | flake | 0 | 2 | 0.0 | 15p2 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p2 | flake | 1 | | |
| 15p3 | flake | 3 | 6 | 50.0 | 15p3 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p3 | flake | 1 | | |
| 15p4 | flake | 1 | 1 | 100.0 | 15p4 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p4 | flake | 1 | | |
| 15p5 | flake | 2 | 4 | 50.0 | 15p5 | flake | 3 | 21 | 16 | 3.4 | 0.9 | 8.9 | 15p5 | flake | 1 | | |
| 15p6 | flake | 2 | 2 | 100.0 | 15p6 | flake | 3 | 24.7 | 17 | 4.2 | 0.7 | 7.1 | 15p6 | flake | 1 | | |
| 15p8 | flake | 2 | 4 | 50.0 | 15p8 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 15p8 | flake | 1 | | |
| 15p9 | flake | 3 | 3 | 100.0 | 15p9 | flake | 4 | 29 | 14 | 4.1 | 1.0 | 9.9 | 15p9 | flake | 1 | | |
| 15p10 | flake | 3 | 5 | 60.0 | 15p10 | flake | 2 | 33.5 | 22.2 | 7.4 | 0.3 | 2.7 | 15p10 | flake | 1 | | |
| 15p11 | core, pi | 5 | 12 | 41.7 | 15p11 | core, pi | 2 | 21.5 | 23.4 | 5.0 | 0.4 | 4.0 | 15p11 | core, pi | 1 | | |
| 15s1 | flake | 0 | 1 | 0.0 | 15s1 | flake | 3 | 18.3 | 13.3 | 2.4 | 1.2 | 12.3 | 15s1 | flake | 1 | | |
| 15s2 | chunk | 3 | 6 | 50.0 | 15s2 | chunk | 3 | 18 | 16.5 | 3.0 | 1.0 | 10.1 | 15s2 | chunk | | 1 | |
| 15s3 | flake | 2 | 2 | 100.0 | 15s3 | flake | 3 | 24 | 10.4 | 2.5 | 1.2 | 12.0 | 15s3 | flake | | 1 | |
| 15s4 | flake | 3 | 7 | 42.9 | 15s4 | flake | 3 | 19.2 | 18.5 | 3.6 | 0.8 | 8.4 | 15s4 | flake | 1 | | |
| 15s6 | core, p | 5 | 12 | 41.7 | 15s6 | core, p | 7 | 28.5 | 24 | 6.8 | 1.0 | 10.2 | 15s6 | core, p | 1 | | |
| 15s7 | chunk | 2 | 2 | 100.0 | 15s7 | chunk | 2 | 20.7 | 14.4 | 3.0 | 0.7 | 6.7 | 15s7 | chunk | | 1 | |
| 15s10 | core, p | 10 | 14 | 71.4 | 15s10 | core, p | 10 | 27.6 | 23.4 | 6.5 | 1.5 | 15.5 | 15s10 | core, p | | 1 | |
| 21i1 | flake | 0 | 9 | 0.0 | 21i1 | flake | 4 | 20.1 | 14.1 | 2.8 | 1.4 | 14.1 | 21i1 | flake | 1 | | |
| 21i2 | flake | 7 | 10 | 70.0 | 21i2 | flake | 10 | 22.1 | 20.3 | 4.5 | 2.2 | 22.3 | 21i2 | flake | | 1 | |
| 21i3 | flake | 1 | 1 | 100.0 | 21i3 | flake | 22 | 12 | 11.4 | 1.4 | 16.1 | 160.8 | 21i3 | flake | | | 1 |
| 21i4 | flake | 1 | 1 | 100.0 | 21i4 | flake | 5 | 25.3 | 9.6 | 2.4 | 2.1 | 20.6 | 21i4 | flake | | | 1 |
| 21i5 | chunk | 3 | 4 | 75.0 | 21i5 | chunk | 12 | 18.7 | 12 | 2.2 | 5.3 | 53.5 | 21i5 | chunk | | | 1 |
| 21i6 | flake | 3 | 3 | 100.0 | 21i6 | flake | 6 | 29.7 | 28.8 | 8.6 | 0.7 | 7.0 | 21i6 | flake | | 1 | |
| 21i9 | flake | 3 | 3 | 100.0 | 21i9 | flake | 12 | 40.4 | 18 | 7.3 | 1.7 | 16.5 | 21i9 | flake | | 1 | |
| 21i10 | core, frag | 14 | 21 | 66.7 | 21i10 | core, frag | 7 | 17.4 | 12 | 2.1 | 3.4 | 33.5 | 21i10 | core, frag | | 1 | |
| 21q1 | flake | 0 | 1 | 0.0 | 21q1 | flake | 0 | 17.7 | 17.7 | 3.1 | 0.0 | 0.0 | 21q1 | flake | 1 | | |
| 21q2 | flake | 0 | 9 | 0.0 | 21q2 | flake | 0 | 24 | 20.5 | 4.9 | 0.0 | 0.0 | 21q2 | flake | 1 | | |
| 21q3 | flake | 0 | 6 | 0.0 | 21q3 | flake | 0 | 23.5 | 19.8 | 4.7 | 0.0 | 0.0 | 21q3 | flake | 1 | | |
| 21q4 | flake | 0 | 1 | 0.0 | 21q4 | flake | 1 | 28.2 | 20.2 | 5.7 | 0.2 | 1.8 | 21q4 | flake | 1 | | |
| 21q5 | flake | 0 | 5 | 0.0 | 21q5 | flake | 1 | 32.7 | 14.3 | 4.7 | 0.2 | 2.1 | 21q5 | flake | 1 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21q7 | flake | 2 | 5 | 40.0 | 21q7 | flake | 1 | 29 | 23.2 | 6.7 | 0.1 | 1.5 | 21q7 | flake | 1 | |
| 21q8 | flake | 4 | 8 | 50.0 | 21q8 | flake | 2 | 29 | 26.3 | 7.6 | 0.3 | 2.6 | 21q8 | flake | 1 | |
| 21q9 | flake | 1 | 4 | 25.0 | 21q9 | flake | 2 | 33.5 | 31.6 | 10.6 | 0.2 | 1.9 | 21q9 | flake | 1 | |
| 8b1 | flake | 1 | 1 | 100.0 | 8b1 | flake | 12 | 19.6 | 13.6 | 2.7 | 4.5 | 45.0 | 8b1 | flake | | 1 |
| 8b2 | core, casual | 5 | 6 | 83.3 | 8b2 | core, casual | 19 | 15.3 | 15.3 | 2.3 | 8.1 | 81.2 | 8b2 | core, casual | | 1 |
| 8b3 | chunk | 13 | 13 | 100.0 | 8b3 | chunk | 11 | 21.4 | 12 | 2.6 | 4.3 | 42.8 | 8b3 | chunk | | 1 |
| 8b4 | core, pi | 7 | 9 | 77.8 | 8b4 | core, pi | 42 | 28.3 | 28.3 | 8.0 | 5.2 | 52.4 | 8b4 | core, pi | | 1 |
| 8d1 | flake | 1 | 2 | 50.0 | 8d1 | flake | 12 | 13 | 11.2 | 1.5 | 8.2 | 82.4 | 8d1 | flake | | 1 |
| 8d3 | core, p | 8 | 16 | 50.0 | 8d3 | core, p | 22 | 19.6 | 19.6 | 3.8 | 5.7 | 57.3 | 8d3 | core, p | | 1 |
| 5qsurf1 | chunk | 4 | 14 | 28.6 | 5qsurf1 | chunk | 24 | 27.6 | 13.2 | 3.6 | 6.6 | 65.9 | 5qsurf1 | chunk | | 1 |
| 5qsurf3 | core, pi | 6 | 9 | 66.7 | 5qsurf3 | core, pi | 14 | 16.4 | 16.4 | 2.7 | 5.2 | 52.1 | 5qsurf3 | core, pi | | 1 |
| 5msurf3 | flake | 3 | 10 | 30.0 | 5msurf3 | flake | 1 | 42.5 | 32.2 | 13.7 | 0.1 | 0.7 | 5msurf3 | flake | 1 | |
| 14x1 | bip flake | 0 | 3 | 0.0 | 14x1 | bip flake | 1 | 55.6 | 12.6 | 7.0 | 0.1 | 1.4 | 14x1 | bip flake | 1 | |
| 33c2 | flake | 0 | 3 | 0.0 | 33c2 | flake | 1 | 47.2 | 22.2 | 10.5 | 0.1 | 1.0 | 33c2 | flake | 1 | |
| 33c3 | core, p | 6 | 22 | 27.3 | 33c3 | core, p | 1 | 30.3 | 22.6 | 6.8 | 0.1 | 1.5 | 33c3 | core, p | 1 | |
| 20, O2 | chopper | 5 | 16 | 31.3 | 20, O2 | chopper | 2 | 31.2 | 31 | 9.7 | 0.2 | 2.1 | 20, O2 | chopper | 1 | |
| 6n1 | flake | 0 | 5 | 0.0 | 6n1 | flake | 1 | 22 | 20 | 4.4 | 0.2 | 2.3 | 6n1 | flake | 1 | |
| 5stsurf2 | flake | 0 | 4 | 0.0 | 5stsurf2 | flake | 1 | 28.7 | 19 | 5.5 | 0.2 | 1.8 | 5stsurf2 | flake | 1 | |
| 5stsurf3 | flake | 2 | 6 | 33.3 | 5stsurf3 | flake | 3 | 36.3 | 20 | 7.3 | 0.4 | 4.1 | 5stsurf3 | flake | 1 | |
| 8a1 | flake | 0 | 1 | 0.0 | 8a1 | flake | 2 | 21 | 21 | 4.4 | 0.5 | 4.5 | 8a1 | flake | 1 | |
| 8a3 | flake | 3 | 11 | 27.3 | 8a3 | flake | 2 | 38.8 | 22 | 8.5 | 0.2 | 2.3 | 8a3 | flake | 1 | |
| 10x3 | core, p | 7 | 31 | 22.6 | 10x3 | core, p | 6 | 28.2 | 23 | 6.5 | 0.9 | 9.3 | 10x3 | core, p | 1 | |
| 5w1 | flake | 1 | 2 | 50.0 | 5w1 | flake | 3 | 23 | 16.6 | 3.8 | 0.8 | 7.9 | 5w1 | flake | 1 | |
| 5w3 | flake | 3 | 11 | 27.3 | 5w3 | flake | 10 | 26.7 | 24.4 | 6.5 | 1.5 | 15.3 | 5w3 | flake | 1 | |
| 10ac1 | bip flake | 0 | 2 | 0.0 | 10ac1 | bip flake | 0 | 19.5 | 19.4 | 3.8 | 0.0 | 0.0 | 10ac1 | bip flake | 1 | |
| 10ac2 | core, bip | 1 | 6 | 16.7 | 10ac2 | core, bip | 3 | 30 | 24 | 7.2 | 0.4 | 4.2 | 10ac2 | core, bip | 1 | |
| 5v1 | bip flake | 3 | 6 | 50.0 | 5v1 | bip flake | 4 | 30.8 | 15.5 | 4.8 | 0.8 | 8.4 | 5v1 | bip flake | 1 | |
| 5v2 | bip flake | 1 | 4 | 25.0 | 5v2 | bip flake | 3 | 37.5 | 12 | 4.5 | 0.7 | 6.7 | 5v2 | bip flake | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5v3 | core, bip | 5 | 12 | 41.7 | 5v3 | core, bip | 4 | 32.5 | 17.5 | 5.7 | 0.7 | 7.0 | 5v3 | core, bip | 1 | | |
| 5usurf1 | flake | 2 | 4 | 50.0 | 5usurf1 | flake | 6 | 27.5 | 22 | 6.1 | 1.0 | 9.9 | 5usurf1 | flake | | 1 | |
| 5usurf3 | core, cent | 4 | 26 | 15.4 | 5usurf3 | core, cent | 4 | 31.7 | 24 | 7.6 | 0.5 | 5.3 | 5usurf3 | core, cent | 1 | | |
| 8f1 | flake | 0 | 2 | 0.0 | 8f1 | flake | 4 | 20.4 | 16.3 | 3.3 | 1.2 | 12.0 | 8f1 | flake | 1 | | |
| 8f2 | flake | 1 | 5 | 20.0 | 8f2 | flake | 5 | 28 | 18 | 5.0 | 1.0 | 9.9 | 8f2 | flake | 1 | | |
| 8f3 | core, cent | 10 | 14 | 71.4 | 8f3 | core, cent | 6 | 21.6 | 20 | 4.3 | 1.4 | 13.9 | 8f3 | core, cent | | 1 | |
| 8c1 | flake | 2 | 7 | 28.6 | 8c1 | flake | 4 | 34.8 | 24 | 8.4 | 0.5 | 4.8 | 8c1 | flake | 1 | | |
| 32f1 | flake | 7 | 7 | 100.0 | 32f1 | flake | 3 | 19 | 17 | 3.2 | 0.9 | 9.3 | 32f1 | flake | | | 1 |
| 32f2 | flake | 4 | 5 | 80.0 | 32f2 | flake | 5 | 33.2 | 17.6 | 5.8 | 0.9 | 8.6 | 32f2 | flake | | | 1 |
| 32f3 | flake | 3 | 3 | 100.0 | 32f3 | flake | 8 | 38 | 34.2 | 13.0 | 0.6 | 6.2 | 32f3 | flake | | | 1 |
| 32f4 | flake | 4 | 5 | 80.0 | 32f4 | flake | 4 | 42.4 | 36 | 15.3 | 0.3 | 2.6 | 32f4 | flake | | | 1 |
| 32f5 | flake | 1 | 3 | 33.3 | 32f5 | flake | 6 | 44 | 28.6 | 12.6 | 0.5 | 4.8 | 32f5 | flake | | | 1 |
| S32e1 | flake | 2 | 3 | 66.7 | S32e1 | flake | 15 | 15.5 | 15.5 | 2.4 | 6.2 | 62.4 | S32e1 | flake | | | 1 |
| S32e2 | flake | 2 | 2 | 100.0 | S32e2 | flake | 20 | 19 | 19 | 3.6 | 5.5 | 55.4 | S32e2 | flake | | | 1 |
| S32e3 | flake | 2 | 3 | 66.7 | S32e3 | flake | 17 | 11.5 | 11.3 | 1.3 | 13.1 | 130.8 | S32e3 | flake | | | 1 |
| S32e5 | chunk | 6 | 6 | 100.0 | S32e5 | chunk | 17 | 22.4 | 14.8 | 3.3 | 5.1 | 51.3 | S32e5 | chunk | | | 1 |
| 14i1 | flake | 2 | 3 | 66.7 | 14i1 | flake | 7 | 8.7 | 8.1 | 0.7 | 9.9 | 99.3 | 14i1 | flake | | 1 | |
| 14i2 | flake | 2 | 4 | 50.0 | 14i2 | flake | 10 | 19.5 | 8 | 1.6 | 6.4 | 64.1 | 14i2 | flake | | 1 | |
| 14i3 | core, pi | 8 | 13 | 61.5 | 14i3 | core, pi | 20 | 17.3 | 15.7 | 2.7 | 7.4 | 73.6 | 14i3 | core, pi | | | 1 |
| 10q1 | flake | 3 | 4 | 75.0 | 10q1 | flake | 15 | 16 | 6.8 | 1.1 | 13.8 | 137.9 | 10q1 | flake | | | 1 |
| 10q2 | core, p | 8 | 14 | 57.1 | 10q2 | core, p | 16 | 23.7 | 9.2 | 2.2 | 7.3 | 73.4 | 10q2 | core, p | | 1 | |
| 10q3 | chunk | 6 | 6 | 100.0 | 10q3 | chunk | 15 | 18.3 | 11.3 | 2.1 | 7.3 | 72.5 | 10q3 | chunk | | | 1 |
| 10aa1 | flake | 1 | 3 | 33.3 | 10aa1 | flake | 14 | 28 | 18.5 | 5.2 | 2.7 | 27.0 | 10aa1 | flake | | 1 | |
| 5Osurf1 | flake | 1 | 1 | 100.0 | 5Osurf1 | flake | 8 | 22.6 | 13 | 2.9 | 2.7 | 27.2 | 5Osurf1 | flake | | | 1 |
| 13b1 | flake | 3 | 9 | 33.3 | 13b1 | flake | 30 | 32 | 17 | 5.4 | 5.5 | 55.1 | 13b1 | flake | | 1 | |
| 13b2 | flake | 4 | 8 | 50.0 | 13b2 | flake | 31 | 29 | 15.7 | 4.6 | 6.8 | 68.1 | 13b2 | flake | | 1 | |
| 13b3 | flake | 1 | 2 | 50.0 | 13b3 | flake | 15 | 28.2 | 10.7 | 3.0 | 5.0 | 49.7 | 13b3 | flake | 1 | | |
| 13b5 | core, p | 10 | 16 | 62.5 | 13b5 | core, p | 10 | 13.8 | 10.7 | 1.5 | 6.8 | 67.7 | 13b5 | core, p | 1 | | |
| 8g2 | flake | 0 | 1 | 0.0 | 8g2 | flake | 16 | 32 | 17 | 5.4 | 2.9 | 29.4 | 8g2 | flake | 1 | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8g3 | flake | 2 | 6 | 33.3 | 8g3 | flake | 11 | 32.8 | 17 | 5.6 | 2.0 | 19.7 | 8g3 | flake | | 1 | |
| 8g4 | flake | 4 | 5 | 80.0 | 8g4 | flake | 32 | 35.5 | 26.8 | 9.5 | 3.4 | 33.6 | 8g4 | flake | | 1 | |
| 8g5 | core, cent | 5 | 21 | 23.8 | 8g5 | core, cent | 11 | 16.7 | 13.8 | 2.3 | 4.8 | 47.7 | 8g5 | core, cent | | 1 | |
| 20aq1 | flake | 0 | 3 | 0.0 | 20aq1 | flake | 20 | 16.2 | 14.3 | 2.3 | 8.6 | 86.3 | 20aq1 | flake | | 1 | |
| 20aq3 | flake | 1 | 1 | 100.0 | 20aq3 | flake | 7 | 20.5 | 19.4 | 4.0 | 1.8 | 17.6 | 20aq3 | flake | | | 1 |
| 20aq4 | retouch | 2 | 9 | 22.2 | 20aq4 | retouch | 22 | 23 | 12.6 | 2.9 | 7.6 | 75.9 | 20aq4 | retouch | | 1 | |
| 20aq5 | core, p | 5 | 34 | 14.7 | 20aq5 | core, p | 15 | 12.4 | 9.2 | 1.1 | 13.1 | 131.5 | 20aq5 | core, p | | 1 | |
| 5nsurf1 | flake | 2 | 6 | 33.3 | 5nsurf1 | flake | 10 | 10.5 | 8.8 | 0.9 | 10.8 | 108.2 | 5nsurf1 | flake | | 1 | |
| 5nsurf3 | core, pi | 10 | 20 | 50.0 | 5nsurf3 | core, pi | 18 | 22.2 | 17.8 | 4.0 | 4.6 | 45.6 | 5nsurf3 | core, pi | | 1 | |
| 5nsurf5 | core, frag | 7 | 18 | 38.9 | 5nsurf5 | core, frag | 18 | 18.1 | 9.7 | 1.8 | 10.3 | 102.5 | 5nsurf5 | core, frag | | | 1 |
| S6e1 | retouch | 7 | 12 | 58.3 | S6e1 | retouch | 15 | 45.2 | 21.8 | 9.9 | 1.5 | 15.2 | S6e1 | retouch | | 1 | |
| S6e2 | chunk | 9 | 11 | 81.8 | S6e2 | chunk | 9 | 39.8 | 25.6 | 10.2 | 0.9 | 8.8 | S6e2 | chunk | | 1 | |
| S6e3 | flake | 7 | 11 | 63.6 | S6e3 | flake | 13 | 43 | 31.8 | 13.7 | 1.0 | 9.5 | S6e3 | flake | | 1 | |
| S6e5 | flake | 5 | 13 | 38.5 | S6e5 | flake | 17 | 44 | 33 | 14.5 | 1.2 | 11.7 | S6e5 | flake | | 1 | |
| S6e6 | flake | 6 | 6 | 100.0 | S6e6 | flake | 11 | 34 | 17 | 5.8 | 1.9 | 19.0 | S6e6 | flake | | 1 | |
| S6e7 | flake | 10 | 11 | 90.9 | S6e7 | flake | 18 | 63 | 29 | 18.3 | 1.0 | 9.9 | S6e7 | flake | | 1 | |
| S6e9 | core, pi | 19 | 29 | 65.5 | S6e9 | core, pi | 13 | 24.2 | 18.3 | 4.4 | 2.9 | 29.4 | S6e9 | core, pi | | 1 | |
| 20ap2 | flake | 1 | 1 | 100.0 | 20ap2 | flake | 7 | 41.6 | 14.5 | 6.0 | 1.2 | 11.6 | 20ap2 | flake | | 1 | |
| 20ap3 | core, p | 8 | 22 | 36.4 | 20ap3 | core, p | 6 | 45.6 | 24 | 10.9 | 0.5 | 5.5 | 20ap3 | core, p | | 1 | |
| 6j1 | flake | 0 | 5 | 0.0 | 6j1 | flake | 7 | 33.5 | 26.5 | 8.9 | 0.8 | 7.9 | 6j1 | flake | | 1 | |
| 6j2 | flake | 2 | 6 | 33.3 | 6j2 | flake | 12 | 43.7 | 11.5 | 5.0 | 2.4 | 23.9 | 6j2 | flake | 1 | | |
| 6j3 | core, flat | 5 | 19 | 26.3 | 6j3 | core, flat | 14 | 38.7 | 36.5 | 14.1 | 1.0 | 9.9 | 6j3 | core, flat | | 1 | |
| 10p1 | chunk | 2 | 8 | 25.0 | 10p1 | chunk | 21 | 46.7 | 24.2 | 11.3 | 1.9 | 18.6 | 10p1 | chunk | | 1 | |
| 5hsurf3 | chunk | 7 | 10 | 70.0 | 5hsurf3 | chunk | 3 | 33.7 | 19.2 | 6.5 | 0.5 | 4.6 | 5hsurf3 | chunk | | 1 | |
| 6m1 | flake | 2 | 5 | 40.0 | 6m1 | flake | 3 | 30 | 21.5 | 6.5 | 0.5 | 4.7 | 6m1 | flake | 1 | | |
| 6m3 | core, pi | 1 | 13 | 7.7 | 6m3 | core, pi | 6 | 30 | 24.6 | 7.4 | 0.8 | 8.1 | 6m3 | core, pi | | 1 | |
| S11e1 | retouch | 2 | 17 | 11.8 | S11e1 | retouch | 1 | 18.4 | 12 | 2.2 | 0.5 | 4.5 | S11e1 | retouch | 1 | | |
| S11e2 | flake | 1 | 1 | 100.0 | S11e2 | flake | 8 | 32 | 24 | 7.7 | 1.0 | 10.4 | S11e2 | flake | | 1 | |
| S8e1 | flake | 2 | 5 | 40.0 | S8e1 | flake | 6 | 20.3 | 12.6 | 2.6 | 2.3 | 23.5 | S8e1 | flake | | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S8e2 | flake | 1 | 8 | 12.5 | S8e2 | flake | 1 | 23 | 21 | 4.8 | 0.2 | 2.1 | S8e2 | flake | | 1 | |
| S8e3 | flake | 0 | 2 | 0.0 | S8e3 | flake | 14 | 42.3 | 25.3 | 10.7 | 1.3 | 13.1 | S8e3 | flake | 1 | | |
| 5rsurf1 | chunk | 0 | 4 | 0.0 | 5rsurf1 | chunk | 7 | 17.6 | 14.2 | 2.5 | 2.8 | 28.0 | 5rsurf1 | chunk | 1 | | |
| 5rsurf2 | flake | 1 | 4 | 25.0 | 5rsurf2 | flake | 9 | 27.7 | 17 | 4.7 | 1.9 | 19.1 | 5rsurf2 | flake | | 1 | |
| 5rsurf3 | flake | 1 | 2 | 50.0 | 5rsurf3 | flake | 7 | 28 | 24.6 | 6.9 | 1.0 | 10.2 | 5rsurf3 | flake | | 1 | |
| 6L1 | flake | 4 | 7 | 57.1 | 6L1 | flake | 5 | 27 | 22.5 | 6.1 | 0.8 | 8.2 | 6L1 | flake | | 1 | |
| 6L2 | core, cent | 2 | 15 | 13.3 | 6L2 | core, cent | 3 | 26.9 | 26.6 | 7.2 | 0.4 | 4.2 | 6L2 | core, cent | | 1 | |
| 14a1 | flake | 3 | 7 | 42.9 | 14a1 | flake | 3 | 29.4 | 11 | 3.2 | 0.9 | 9.3 | 14a1 | flake | 1 | | |
| 14a3 | flake | 4 | 6 | 66.7 | 14a3 | flake | 15 | 40.8 | 26.5 | 10.8 | 1.4 | 13.9 | 14a3 | flake | | 1 | |
| 10b2 | flake | 3 | 3 | 100.0 | 10b2 | flake | 6 | 36.2 | 28 | 10.1 | 0.6 | 5.9 | 10b2 | flake | | 1 | |
| 10b4 | core, p | 30 | 36 | 83.3 | 10b4 | core, p | 18 | 42 | 20.4 | 8.6 | 2.1 | 21.0 | 10b4 | core, p | | 1 | |
| 32g1 | bip flake | 2 | 2 | 100.0 | 32g1 | bip flake | 2 | 38 | 10.6 | 4.0 | 0.5 | 5.0 | 32g1 | bip flake | | 1 | |
| 32g2 | bip flake | 1 | 1 | 100.0 | 32g2 | bip flake | 7 | 34.4 | 18.8 | 6.5 | 1.1 | 10.8 | 32g2 | bip flake | | 1 | |
| 6k2 | core, cent | 16 | 25 | 64.0 | 6k2 | core, cent | 4 | 24 | 20.4 | 4.9 | 0.8 | 8.2 | 6k2 | core, cent | | 1 | |
| 6k3 | chunk | 4 | 4 | 100.0 | 6k3 | chunk | 3 | 23.6 | 19.3 | 4.6 | 0.7 | 6.6 | 6k3 | chunk | | 1 | |
| 6b,c3 | flake | 6 | 6 | 100.0 | 6b,c3 | flake | 17 | 20 | 12.3 | 2.5 | 6.9 | 69.1 | 6b,c3 | flake | | 1 | |
| 6b,c4 | pick | 17 | 33 | 51.5 | 6b,c4 | pick | 10 | 26.6 | 26.6 | 7.1 | 1.4 | 14.1 | 6b,c4 | pick | | 1 | |
| 6i1 | flake | 2 | 5 | 40.0 | 6i1 | flake | 6 | 24.5 | 24.5 | 6.0 | 1.0 | 10.0 | 6i1 | flake | | 1 | |
| 6i3 | core, pi | 8 | 23 | 34.8 | 6i3 | core, pi | 4 | 36 | 19.6 | 7.1 | 0.6 | 5.7 | 6i3 | core, pi | | 1 | |
| 14g2 | core, pi | 7 | 15 | 46.7 | 14g2 | core, pi | 4 | 35.5 | 20.8 | 7.4 | 0.5 | 5.4 | 14g2 | core, pi | | 1 | |
| 14g3 | chunk | 4 | 10 | 40.0 | 14g3 | chunk | 10 | 24.7 | 24.7 | 6.1 | 1.6 | 16.4 | 14g3 | chunk | 1 | | |
| 10w1 | flake | 1 | 1 | 100.0 | 10w1 | flake | 5 | 18.3 | 14.5 | 2.7 | 1.9 | 18.8 | 10w1 | flake | | 1 | |
| 10w2 | retouch | 2 | 6 | 33.3 | 10w2 | retouch | 1 | 20 | 15 | 3.0 | 0.3 | 3.3 | 10w2 | retouch | | 1 | |
| 10w3 | flake | 5 | 6 | 83.3 | 10w3 | flake | 4 | 25.8 | 21 | 5.4 | 0.7 | 7.4 | 10w3 | flake | | 1 | |
| 10w4 | flake | 4 | 5 | 80.0 | 10w4 | flake | 4 | 30.6 | 14.4 | 4.4 | 0.9 | 9.1 | 10w4 | flake | | 1 | |
| 10w5 | chunk | 4 | 4 | 100.0 | 10w5 | chunk | 4 | 26.2 | 18.2 | 4.8 | 0.8 | 8.4 | 10w5 | chunk | | 1 | |
| 10w6 | flake | 2 | 3 | 66.7 | 10w6 | flake | 3 | 31 | 18.8 | 5.8 | 0.5 | 5.1 | 10w6 | flake | | 1 | |
| 10w9 | core, flat | 6 | 13 | 46.2 | 10w9 | core, flat | 4 | 32 | 16 | 5.1 | 0.8 | 7.8 | 10w9 | core, flat | | 1 | |
| 10w10 | core, | 4 | 7 | 57.1 | 10w10 | core, | 5 | 30 | 29.6 | 8.9 | 0.6 | 5.6 | 10w10 | core, casual | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | casual | | | | | casual | | | | | | | | | | | |
| 27c2 | flake | 2 | 2 | 100.0 | 27c2 | flake | 3 | 18.0 | 14.5 | 2.6 | 1.1 | 11.5 | 27c2 | flake | | 1 | |
| 27c3 | flake | 3 | 4 | 75.0 | 27c3 | flake | 3 | 24.0 | 19.5 | 4.7 | 0.6 | 6.4 | 27c3 | flake | | 1 | |
| 27c4 | flake | 2 | 2 | 100.0 | 27c4 | flake | 4 | 24.0 | 22.0 | 5.3 | 0.8 | 7.6 | 27c4 | flake | | 1 | |
| 27c5 | flake | 3 | 6 | 50.0 | 27c5 | flake | 5 | 27.8 | 19.0 | 5.3 | 0.9 | 9.5 | 27c5 | flake | | 1 | |
| 27c6 | flake | 3 | 10 | 30.0 | 27c6 | flake | 2 | 22.7 | 18.6 | 4.2 | 0.5 | 4.7 | 27c6 | flake | | 1 | |
| 27c8 | core, casual | 8 | 11 | 72.7 | 27c8 | core, casual | 4 | 42.8 | 26.2 | 11.2 | 0.4 | 3.6 | 27c8 | core, casual | | 1 | |
| 27c9 | core, pi | 12 | 17 | 70.6 | 27c9 | core, pi | 4 | 35.4 | 33.6 | 11.9 | 0.3 | 3.4 | 27c9 | core, pi | | 1 | |
| 23g1 | chunk | 1 | 2 | 50.0 | 23g1 | chunk | 0 | 25.3 | 13.0 | 3.3 | 0.0 | 0.0 | 23g1 | chunk | | 1 | |
| 23g4 | flake | 6 | 7 | 85.7 | 23g4 | flake | 3 | 34.0 | 20.4 | 6.9 | 0.4 | 4.3 | 23g4 | flake | | | 1 |
| 23g5 | chunk | 9 | 9 | 100.0 | 23g5 | chunk | 4 | 32.4 | 29.2 | 9.5 | 0.4 | 4.2 | 23g5 | chunk | | | 1 |
| 23g6 | flake | 1 | 1 | 100.0 | 23g6 | flake | 2 | 40.0 | 29.4 | 11.8 | 0.2 | 1.7 | 23g6 | flake | | | 1 |
| 23g7 | core, flat | 7 | 7 | 100.0 | 23g7 | core, flat | 5 | 38.2 | 35.5 | 13.6 | 0.4 | 3.7 | 23g7 | core, flat | | 1 | |
| 23g8 | flake | 4 | 4 | 100.0 | 23g8 | flake | 3 | 49.0 | 33.2 | 16.3 | 0.2 | 1.8 | 23g8 | flake | | 1 | |
| 23g9 | flake | 1 | 1 | 100.0 | 23g9 | flake | 3 | 61.0 | 27.0 | 16.5 | 0.2 | 1.8 | 23g9 | flake | | 1 | |
| 23g10 | core, frag | 12 | 17 | 70.6 | 23g10 | core, frag | 3 | 62.0 | 41.2 | 25.5 | 0.1 | 1.2 | 23g10 | core, frag | | 1 | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **174** | | | | 53.1% | **174** | | | | | | | 21.2 | **174** | | 63 | 87 | 24 |
| | | | | | | | | | | | | | | Percentage of sample | 36.2 | 50.0 | 13.8 |

**Table 19: Experimental Acheulean chert raw data.**

Key: Sn – sample number; Tt – tool type; ISCAR – flake scars with impurities; DSCAR – flake scars total on tool; % F – ratio of flaws in percentage; f – no. of fractures; Lmm – length of area sampled, Wmm – width of area sampled; a cm2 – area in centimetres squared; f/cm2 – fractures per centimetre squared; f/10 - cm2 fractures per ten centimetre squared; N - no weathering; S – slight weathering; E – extensive weathering.

| Sn | Tt | Iscar | Dscar | % F | Sn | Tt | f | L, mm | w, mm | a cm2 | f/cm2 | f/10 cm2 | Sn | Tt | N | S | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9a1 | cleaver | 35 | 42 | 83.3 | 9a1 | cleaver | 10 | 37.6 | 31.7 | 11.9 | 0.8 | 8.4 | 9a1 | cleaver | | 1 | |
| 9a2 | core, b/f | 15 | 19 | 78.9 | 9a2 | core, b/f | 10 | 55.3 | 35.6 | 19.7 | 0.5 | 5.1 | 9a2 | core, b/f | | 1 | |
| 9a6 | flake | 4 | 4 | 100.0 | 9a6 | flake | 10 | 53.2 | 44.0 | 23.4 | 0.4 | 4.3 | 9a6 | flake | | 1 | |
| 9b11 | flake | 4 | 5 | 80.0 | 9b11 | flake | 9 | 68.3 | 33.0 | 22.5 | 0.4 | 4.0 | 9b11 | flake | | 1 | |
| 9c2 | flake | 0 | 1 | 0.0 | 9c2 | flake | 0 | 28.4 | 10.1 | 2.9 | 0.0 | 0.0 | 9c2 | flake | | 1 | |
| 9c4 | flake | 2 | 2 | 100.0 | 9c4 | flake | 7 | 25.3 | 16.0 | 4.0 | 1.7 | 17.3 | 9c4 | flake | | 1 | |
| 9c6 | flake | 5 | 5 | 100.0 | 9c6 | flake | 1 | 17.1 | 11.4 | 1.9 | 0.5 | 5.1 | 9c6 | flake | | 1 | |
| 9c7 | chunk | 3 | 3 | 100.0 | 9c7 | chunk | 7 | 28.2 | 20.5 | 5.8 | 1.2 | 12.1 | 9c7 | chunk | | 1 | |
| 9c8 | chunk | 4 | 4 | 100.0 | 9c8 | chunk | 11 | 22.7 | 22.7 | 5.2 | 2.1 | 21.3 | 9c8 | chunk | | 1 | |
| 9c9 | chunk | 5 | 5 | 100.0 | 9c9 | chunk | 10 | 18.3 | 13.2 | 2.4 | 4.1 | 41.4 | 9c9 | chunk | | 1 | |
| 9c12 | flake | 1 | 1 | 100.0 | 9c12 | flake | 24 | 46.0 | 31.0 | 14.3 | 1.7 | 16.8 | 9c12 | flake | | 1 | |
| 9c15 | core, p | 6 | 13 | 46.2 | 9c15 | core, p | 10 | 32.6 | 32.5 | 10.6 | 0.9 | 9.4 | 9c15 | core, p | | 1 | |
| 9c16 | core, pi | 10 | 10 | 100.0 | 9c16 | core, pi | 21 | 41.7 | 41.5 | 17.3 | 1.2 | 12.1 | 9c16 | core, pi | | 1 | |
| 9d8 | chunk | 2 | 3 | 66.7 | 9d8 | chunk | 10 | 46.6 | 19.6 | 9.1 | 1.1 | 10.9 | 9d8 | chunk | | 1 | |
| 9d16 | core, p | 13 | 18 | 72.2 | 9d16 | core, p | 30 | 50.0 | 46.3 | 23.2 | 1.3 | 13.0 | 9d16 | core, p | | 1 | |
| s9e7 | chunk | 3 | 3 | 100.0 | s9e7 | chunk | 5 | 24.2 | 10.8 | 2.6 | 1.9 | 19.1 | s9e7 | chunk | | 1 | |
| s9e12 | flake | 6 | 6 | 100.0 | s9e12 | flake | 19 | 48.2 | 45.0 | 21.7 | 0.9 | 8.8 | s9e12 | flake | | 1 | |
| s9e16 | handaxe | 50 | 50 | 100.0 | s9e16 | handaxe | 24 | 67.0 | 43.5 | 29.1 | 0.8 | 8.2 | s9e16 | handaxe | | 1 | |
| 9f10 | flake | 3 | 3 | 100.0 | 9f10 | flake | 20 | 51.0 | 35.0 | 17.9 | 1.1 | 11.2 | 9f10 | flake | | 1 | |
| 9f16 | core, p | 18 | 22 | 81.8 | 9f16 | core, p | 7 | 29.0 | 22.2 | 6.4 | 1.1 | 10.9 | 9f16 | core, p | | 1 | |
| 9g8 | flake | 4 | 6 | 66.7 | 9g8 | flake | 14 | 48.0 | 31.7 | 15.2 | 0.9 | 9.2 | 9g8 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9g11 | flake | 7 | 10 | 70.0 | 9g11 | flake | 22 | 76.7 | 28.0 | 21.5 | 1.0 | 10.2 | 9g11 | flake | | 1 | |
| 9h2 | flake | 0 | 3 | 0.0 | 9h2 | flake | 0 | 12.4 | 12.4 | 1.5 | 0.0 | 0.0 | 9h2 | flake | 1 | | |
| 9h10 | flake | 0 | 6 | 0.0 | 9h10 | flake | 0 | 38.0 | 32.6 | 12.4 | 0.0 | 0.0 | 9h10 | flake | 1 | | |
| 9h12 | chunk | 1 | 2 | 50.0 | 9h12 | chunk | 2 | 49.0 | 27.4 | 13.4 | 0.1 | 1.5 | 9h12 | chunk | | 1 | |
| 9h16 | core, p | 2 | 48 | 4.2 | 9h16 | core, p | 3 | 47.5 | 26.5 | 12.6 | 0.2 | 2.4 | 9h16 | core, p | 1 | | |
| 9i1 | flake | 0 | 2 | 0.0 | 9i1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i1 | flake | | 1 | |
| 9i7 | flake | 0 | 4 | 0.0 | 9i7 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i7 | flake | | 1 | |
| 9i12 | flake | 6 | 8 | 75.0 | 9i12 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9i12 | flake | | 1 | |
| 9i14 | chunk | 4 | 4 | 100.0 | 9i14 | chunk | 2 | 36.0 | 36.0 | 13.0 | 0.2 | 1.5 | 9i14 | chunk | | 1 | |
| 9i16 | core, p | 14 | 27 | 51.9 | 9i16 | core, p | 1 | 83.3 | 76.0 | 63.3 | 0.0 | 0.2 | 9i16 | core, p | | 1 | |
| 9j5 | chunk | 7 | 9 | 77.8 | 9j5 | chunk | 6 | 21.8 | 20.0 | 4.4 | 1.4 | 13.8 | 9j5 | chunk | | 1 | |
| 9j16 | core, c | 8 | 12 | 66.7 | 9j16 | core, c | 12 | 32.0 | 32.0 | 10.2 | 1.2 | 11.7 | 9j16 | core, c | | 1 | |
| 9k7 | chunk | 0 | 8 | 0.0 | 9k7 | chunk | 4 | 25.3 | 16.2 | 4.1 | 1.0 | 9.8 | 9k7 | chunk | | 1 | |
| 9k8 | flake | 0 | 4 | 0.0 | 9k8 | flake | 2 | 24.8 | 22.3 | 5.5 | 0.4 | 3.6 | 9k8 | flake | | 1 | |
| 9L1 | flake | 0 | 7 | 0.0 | 9L1 | flake | 2 | 23.4 | 7.5 | 1.8 | 1.1 | 11.4 | 9L1 | flake | 1 | | |
| 9L2 | flake | 3 | 7 | 42.9 | 9L2 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L2 | flake | 1 | | |
| 9L4 | flake | 2 | 4 | 50.0 | 9L4 | flake | 1 | 22.0 | 11.1 | 2.4 | 0.4 | 4.1 | 9L4 | flake | 1 | | |
| 9L8 | flake | 5 | 6 | 83.3 | 9L8 | flake | 2 | 22.3 | 17.8 | 4.0 | 0.5 | 5.0 | 9L8 | flake | | 1 | |
| 9L10 | flake | 2 | 5 | 40.0 | 9L10 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L10 | flake | 1 | | |
| 9L12 | flake | 5 | 5 | 100.0 | 9L12 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9L12 | flake | | 1 | |
| 9L13 | chunk | 2 | 2 | 100.0 | 9L13 | chunk | 2 | 23.3 | 22.2 | 5.2 | 0.4 | 3.9 | 9L13 | chunk | | 1 | |
| 9L14 | flake | 6 | 8 | 75.0 | 9L14 | flake | 1 | 47.5 | 29.0 | 13.8 | 0.1 | 0.7 | 9L14 | flake | | 1 | |
| 9L16 | core, c/p | 24 | 37 | 64.9 | 9L16 | core, c/p | 1 | 43.8 | 35.7 | 15.6 | 0.1 | 0.6 | 9L16 | core, c/p | | 1 | |
| 9m10 | flake | 4 | 9 | 44.4 | 9m10 | flake | 7 | 27.5 | 25.2 | 6.9 | 1.0 | 10.1 | 9m10 | flake | | 1 | |
| 9m12 | chunk | 2 | 15 | 13.3 | 9m12 | chunk | 5 | 31.0 | 28.7 | 8.9 | 0.6 | 5.6 | 9m12 | chunk | | 1 | |
| 9m15 | core, c | 3 | 23 | 13.0 | 9m15 | core, c | 7 | 29.5 | 25.8 | 7.6 | 0.9 | 9.2 | 9m15 | core, c | | 1 | |
| 9n1 | flake | 0 | 2 | 0.0 | 9n1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n1 | flake | | 1 | |
| 9n4 | flake | 1 | 4 | 25.0 | 9n4 | flake | 2 | 19.4 | 16.2 | 3.1 | 0.6 | 6.4 | 9n4 | flake | | 1 | |
| 9n5 | flake | 4 | 4 | 100.0 | 9n5 | flake | 1 | 25.5 | 17.0 | 4.3 | 0.2 | 2.3 | 9n5 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9n6 | flake | 1 | 6 | 16.7 | 9n6 | flake | 1 | 23.2 | 17.8 | 4.1 | 0.2 | 2.4 | 9n6 | flake | | 1 | |
| 9n7 | flake | 5 | 9 | 55.6 | 9n7 | flake | 1 | 26.0 | 26.0 | 6.8 | 0.1 | 1.5 | 9n7 | flake | | 1 | |
| 9n9 | flake | 4 | 4 | 100.0 | 9n9 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n9 | flake | | 1 | |
| 9n12 | chunk | 5 | 5 | 100.0 | 9n12 | chunk | 2 | 22.0 | 16.5 | 3.6 | 0.6 | 5.5 | 9n12 | chunk | | 1 | |
| 9n14 | chunk | 3 | 4 | 75.0 | 9n14 | chunk | 1 | 28.6 | 28.0 | 8.0 | 0.1 | 1.2 | 9n14 | chunk | | 1 | |
| 9n15 | chunk | 10 | 12 | 83.3 | 9n15 | chunk | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9n15 | chunk | | 1 | |
| 9n16 | core, pi | 18 | 23 | 78.3 | 9n16 | core, pi | 2 | 46.0 | 24.0 | 11.0 | 0.2 | 1.8 | 9n16 | core, pi | | 1 | |
| 9o14 | flake | 1 | 3 | 33.3 | 9o14 | flake | 4 | 41.8 | 21.7 | 9.1 | 0.4 | 4.4 | 9o14 | flake | | 1 | |
| 9o15 | flake | 5 | 6 | 83.3 | 9o15 | flake | 2 | 35.7 | 25.4 | 9.1 | 0.2 | 2.2 | 9o15 | flake | | 1 | |
| 9o17 | handaxe/ point | 9 | 31 | 29.0 | 9o17 | handaxe/ point | 3 | 48.6 | 44.0 | 21.4 | 0.1 | 1.4 | 9o17 | handaxe/ point | | 1 | |
| 9p3 | flake | 0 | 2 | 0.0 | 9p3 | flake | 4 | 18.2 | 17.5 | 3.2 | 1.3 | 12.6 | 9p3 | flake | | 1 | |
| 9p12 | chunk | 1 | 7 | 14.3 | 9p12 | chunk | 1 | 36.0 | 17.6 | 6.3 | 0.2 | 1.6 | 9p12 | chunk | 1 | | |
| 9p16 | core, pi | 5 | 15 | 33.3 | 9p16 | core, pi | 6 | 38.4 | 34.8 | 13.4 | 0.4 | 4.5 | 9p16 | core, pi | 1 | | |
| 9q3 | flake | 1 | 5 | 20.0 | 9q3 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 9q3 | flake | | | 1 |
| 9q5 | flake | 2 | 3 | 66.7 | 9q5 | flake | 2 | 22.3 | 15.3 | 3.4 | 0.6 | 5.9 | 9q5 | flake | | | 1 |
| 9q9 | chunk | 3 | 5 | 60.0 | 9q9 | chunk | 1 | 23.7 | 7.0 | 1.7 | 0.6 | 6.0 | 9q9 | chunk | | | 1 |
| 9q11 | chunk | 5 | 7 | 71.4 | 9q11 | chunk | 2 | 33.0 | 27.0 | 8.9 | 0.2 | 2.2 | 9q11 | chunk | | | 1 |
| 9q12 | core, pi | 6 | 13 | 46.2 | 9q12 | core, pi | 1 | 42.0 | 37.3 | 15.7 | 0.1 | 0.6 | 9q12 | core, pi | | | 1 |
| 9r11 | flake | 1 | 12 | 8.3 | 9r11 | flake | 2 | 25.8 | 21.0 | 5.4 | 0.4 | 3.7 | 9r11 | flake | | 1 | |
| 9r12 | chunk | 1 | 10 | 10.0 | 9r12 | chunk | 1 | 18.3 | 18.3 | 3.3 | 0.3 | 3.0 | 9r12 | chunk | | 1 | |
| 15g1 | flake | 3 | 3 | 100.0 | 15g1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g1 | flake | | | 1 |
| 15g2 | flake | 1 | 1 | 100.0 | 15g2 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g2 | flake | | | 1 |
| 15g4 | chunk | 4 | 4 | 100.0 | 15g4 | chunk | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15g4 | chunk | | | 1 |
| 15g5 | chunk | 6 | 6 | 100.0 | 15g5 | chunk | 1 | 41.4 | 31.4 | 13.0 | 0.1 | 0.8 | 15g5 | chunk | | | 1 |
| 16h1 | flake | 3 | 3 | 100.0 | 16h1 | flake | 4 | 23.4 | 17.0 | 4.0 | 1.0 | 10.1 | 16h1 | flake | 1 | | |
| 19f/g2 | flake | 2 | 5 | 40.0 | 19f/g2 | flake | 5 | 37.0 | 34.4 | 12.7 | 0.4 | 3.9 | 19f/g2 | flake | | 1 | |
| 19f/g3 | core, pi | 19 | 21 | 90.5 | 19f/g3 | core, pi | 9 | 36.7 | 35.5 | 13.0 | 0.7 | 6.9 | 19f/g3 | core, pi | | 1 | |
| 16d1 | flake | 3 | 4 | 75.0 | 16d1 | flake | 4 | 48.0 | 22.0 | 10.6 | 0.4 | 3.8 | 16d1 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| s16e1 | flake | 7 | 11 | 63.6 | s16e1 | flake | 6 | 47.2 | 22 | 10.4 | 0.6 | 5.8 | s16e1 | flake | | 1 | |
| s16e2 | chunk | 4 | 4 | 100.0 | s16e2 | chunk | 6 | 39.5 | 23.0 | 9.1 | 0.7 | 6.6 | s16e2 | chunk | | 1 | |
| s16e3 | core, pi | 11 | 17 | 64.7 | s16e3 | core, pi | 4 | 37.5 | 16.3 | 6.1 | 0.7 | 6.5 | s16e3 | core, pi | | 1 | |
| 19a2 | flake | 8 | 11 | 72.7 | 19a2 | flake | 9 | 42 | 40 | 16.8 | 0.5 | 5.4 | 19a2 | flake | | 1 | |
| 19a3 | core, p | 28 | 32 | 87.5 | 19a3 | core, p | 10 | 70.6 | 37.6 | 26.5 | 0.4 | 3.8 | 19a3 | core, p | | 1 | |
| 16g1 | chunk | 2 | 6 | 33.3 | 16g1 | chunk | 3 | 27.2 | 25.5 | 6.9 | 0.4 | 4.3 | 16g1 | chunk | | 1 | |
| 16g3 | flake | 4 | 12 | 33.3 | 16g3 | flake | 6 | 43 | 29.3 | 12.6 | 0.5 | 4.8 | 16g3 | flake | | 1 | |
| 15c2 | flake | 4 | 9 | 44.4 | 15c2 | flake | 20 | 54 | 32.5 | 17.6 | 1.1 | 11.4 | 15c2 | flake | | 1 | |
| 15c3 | handaxe | 19 | 33 | 57.6 | 15c3 | handaxe | 31 | 88.0 | 36.7 | 32.3 | 1.0 | 9.6 | 15c3 | handaxe | | 1 | |
| 19b2 | flake | 6 | 10 | 60.0 | 19b2 | flake | 10 | 45.0 | 44.3 | 19.9 | 0.5 | 5.0 | 19b2 | flake | | 1 | |
| 19b4 | core, c | 14 | 23 | 60.9 | 19b4 | core, c | 16 | 48.0 | 45.0 | 21.6 | 0.7 | 7.4 | 19b4 | core, c | | 1 | |
| 19c1 | flake | 5 | 8 | 62.5 | 19c1 | flake | 7 | 58 | 28.5 | 16.5 | 0.4 | 4.2 | 19c1 | flake | | 1 | |
| 19c2 | flake | 3 | 3 | 100.0 | 19c2 | flake | 6 | 44.4 | 33.0 | 14.7 | 0.4 | 4.1 | 19c2 | flake | | 1 | |
| 19c3 | handaxe | 22 | 36 | 61.1 | 19c3 | handaxe | 7 | 54 | 47.7 | 25.8 | 0.3 | 2.7 | 19c3 | handaxe | | 1 | |
| 18a2 | flake | 5 | 8 | 62.5 | 18a2 | flake | 24 | 24.5 | 24.5 | 6.0 | 4.0 | 40.0 | 18a2 | flake | | 1 | |
| 18a3 | core, p | 25 | 27 | 92.6 | 18a3 | core, p | 22 | 26.0 | 28.7 | 7.5 | 2.9 | 29.5 | 18a3 | core, p | | 1 | |
| 18a4 | core chunk | 9 | 14 | 64.3 | 18a4 | core chunk | 14 | 23.5 | 18.7 | 4.4 | 3.2 | 31.9 | 18a4 | core chunk | | 1 | |
| 16c2 | flake | 2 | 10 | 20.0 | 16c2 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | 16c2 | flake | 1 | | |
| 16c3 | flake | 4 | 6 | 66.7 | 16c3 | flake | 10 | 66.0 | 46.0 | 30.4 | 0.3 | 3.3 | 16c3 | flake | 1 | | |
| 16c4 | core, cent | 23 | 49 | 46.9 | 16c4 | core, cent | 1 | 79 | 60 | 47.4 | 0.0 | 0.2 | 16c4 | core, cent | 1 | | |
| 15d3 | flake | 7 | 8 | 87.5 | 15d3 | flake | 7 | 51.0 | 28.0 | 14.3 | 0.5 | 4.9 | 15d3 | flake | 1 | | |
| S19e1 | flake | 0 | 9 | 0.0 | S19e1 | flake | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | S19e1 | flake | 1 | | |
| S19e2 | chopper | 7 | 15 | 46.7 | S19e2 | chopper | 2 | 55.0 | 37.0 | 20.4 | 0.1 | 1.0 | S19e2 | chopper | 1 | | |
| S19e3 | core, cent | 8 | 25 | 32.0 | S19e3 | core, cent | 0 | 1 | 1 | 0.0 | 0.0 | 0.0 | S19e3 | core, cent | 1 | | |
| 15b1 | flake | 3 | 7 | 42.9 | 15b1 | flake | 6 | 21.0 | 12.0 | 2.5 | 2.4 | 23.8 | 15b1 | flake | | 1 | |
| 15b2 | chunk | 10 | 10 | 100.0 | 15b2 | chunk | 4 | 17.7 | 15.6 | 2.8 | 1.4 | 14.5 | 15b2 | chunk | | 1 | |
| 15b3 | flake | 11 | 11 | 100.0 | 15b3 | flake | 6 | 29.0 | 20.5 | 5.9 | 1.0 | 10.1 | 15b3 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15b6 | chunk | 6 | 7 | 85.7 | 15b6 | chunk | 7 | 31.0 | 22.6 | 7.0 | 1.0 | 10.0 | 15b6 | chunk | | 1 | |
| 15b7 | flake | 12 | 12 | 100.0 | 15b7 | flake | 13 | 48.2 | 34.8 | 16.8 | 0.8 | 7.8 | 15b7 | flake | | 1 | |
| 15b8 | flake | 3 | 3 | 100.0 | 15b8 | flake | 21 | 46.4 | 36.4 | 16.9 | 1.2 | 12.4 | 15b8 | flake | | 1 | |
| 15b9 | chunk | 9 | 9 | 100.0 | 15b9 | chunk | 9 | 19.5 | 19.5 | 3.8 | 2.4 | 23.7 | 15b9 | chunk | | 1 | |
| 15b10 | core, p | 26 | 26 | 100.0 | 15b10 | core, p | 11 | 32.4 | 17.7 | 5.7 | 1.9 | 19.2 | 15b10 | core, p | | 1 | |
| 18c1 | flake | 2 | 6 | 33.3 | 18c1 | flake | 6 | 17.7 | 9.2 | 1.6 | 3.7 | 36.8 | 18c1 | flake | | 1 | |
| 18c2 | flake | 1 | 7 | 14.3 | 18c2 | flake | 6 | 19.0 | 14.7 | 2.8 | 2.1 | 21.5 | 18c2 | flake | | 1 | |
| 18c3 | flake | 0 | 8 | 0.0 | 18c3 | flake | 9 | 24.4 | 13.5 | 3.3 | 2.7 | 27.3 | 18c3 | flake | | 1 | |
| 18c4 | flake | 1 | 3 | 33.3 | 18c4 | flake | 3 | 26.7 | 13.5 | 3.6 | 0.8 | 8.3 | 18c4 | flake | | 1 | |
| 18c5 | flake | 2 | 2 | 100.0 | 18c5 | flake | 16 | 35.6 | 13.0 | 4.6 | 3.5 | 34.6 | 18c5 | flake | | 1 | |
| 18c6 | flake | 3 | 3 | 100.0 | 18c6 | flake | 18 | 43.8 | 35.0 | 15.3 | 1.2 | 11.7 | 18c6 | flake | | 1 | |
| 18c7 | flake | 3 | 3 | 100.0 | 18c7 | flake | 21 | 57.0 | 29.2 | 16.6 | 1.3 | 12.6 | 18c7 | flake | | 1 | |
| 18c8 | flake | 2 | 2 | 100.0 | 18c8 | flake | 11 | 44.5 | 18.0 | 8.0 | 1.4 | 13.7 | 18c8 | flake | | 1 | |
| 18c9 | chunk | 9 | 15 | 60.0 | 18c9 | chunk | 16 | 46.3 | 33.4 | 15.5 | 1.0 | 10.3 | 18c9 | chunk | | 1 | |
| 15k1 | flake | 1 | 2 | 50.0 | 15k1 | flake | 0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 15k1 | flake | | 1 | |
| 15k2 | flake | 0 | 4 | 0.0 | 15k2 | flake | 2 | 16.0 | 14.5 | 2.3 | 0.9 | 8.6 | 15k2 | flake | | 1 | |
| 15k3 | flake | 0 | 5 | 0.0 | 15k3 | flake | 3 | 20.8 | 16.0 | 3.3 | 0.9 | 9.0 | 15k3 | flake | | 1 | |
| 15k4 | flake | 0 | 3 | 0.0 | 15k4 | flake | 0 | 25.5 | 16.3 | 4.2 | 0.0 | 0.0 | 15k4 | flake | | 1 | |
| 15k5 | flake | 0 | 7 | 0.0 | 15k5 | flake | 0 | 29.3 | 10.3 | 3.0 | 0.0 | 0.0 | 15k5 | flake | | 1 | |
| 15k6 | chunk | 4 | 8 | 50.0 | 15k6 | chunk | 1 | 21.1 | 19.7 | 4.2 | 0.2 | 2.4 | 15k6 | chunk | | 1 | |
| 15k7 | flake | 2 | 8 | 25.0 | 15k7 | flake | 1 | 34.3 | 23.7 | 8.1 | 0.1 | 1.2 | 15k7 | flake | | 1 | |
| 15k9 | flake | 4 | 10 | 40.0 | 15k9 | flake | 7 | 55.0 | 21.7 | 11.9 | 0.6 | 5.9 | 15k9 | flake | | 1 | |
| 15k10 | core, cent | 6 | 19 | 31.6 | 15k10 | core, cent | 9 | 53.6 | 37.0 | 19.8 | 0.5 | 4.5 | 15k10 | core, cent | | 1 | |
| 16f1 | flake | 0 | 3 | 0.0 | 16f1 | flake | 2 | 16.7 | 12.5 | 2.1 | 1.0 | 9.6 | 16f1 | flake | | 1 | |
| 16f2 | flake | 2 | 7 | 28.6 | 16f2 | flake | 5 | 22.2 | 16.6 | 3.7 | 1.4 | 13.6 | 16f2 | flake | | 1 | |
| 16f3 | flake | 1 | 4 | 25.0 | 16f3 | flake | 6 | 25.4 | 19.0 | 4.8 | 1.2 | 12.4 | 16f3 | flake | | 1 | |
| 16f4 | flake | 0 | 4 | 0.0 | 16f4 | flake | 5 | 37.0 | 14.7 | 5.4 | 0.9 | 9.2 | 16f4 | flake | | 1 | |
| 16f5 | flake | 1 | 6 | 16.7 | 16f5 | flake | 2 | 33.0 | 21.3 | 7.0 | 0.3 | 2.8 | 16f5 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16f6 | flake | 0 | 5 | 0.0 | 16f6 | flake | 4 | 33.0 | 30.0 | 9.9 | 0.4 | 4.0 | 16f6 | flake | | 1 | |
| 16f7 | flake | 2 | 5 | 40.0 | 16f7 | flake | 2 | 34.5 | 27.5 | 9.5 | 0.2 | 2.1 | 16f7 | flake | | 1 | |
| 16f8 | flake | 2 | 7 | 28.6 | 16f8 | flake | 8 | 46.3 | 32.0 | 14.8 | 0.5 | 5.4 | 16f8 | flake | | 1 | |
| 16f10 | core, p | 5 | 29 | 17.2 | 16f10 | core, p | 5 | 45.0 | 37.0 | 16.7 | 0.3 | 3.0 | 16f10 | core, p | | 1 | |
| 15i1 | chunk | 4 | 4 | 100.0 | 15i1 | chunk | 2 | 15.7 | 10.2 | 1.6 | 1.2 | 12.5 | 15i1 | chunk | | 1 | |
| 15i2 | chunk | 2 | 2 | 100.0 | 15i2 | chunk | 2 | 15.3 | 13.3 | 2.0 | 1.0 | 9.8 | 15i2 | chunk | | 1 | |
| 15i3 | flake | 1 | 3 | 33.3 | 15i3 | flake | 4 | 22.6 | 8.0 | 1.8 | 2.2 | 22.1 | 15i3 | flake | | 1 | |
| 15i4 | chunk | 2 | 6 | 33.3 | 15i4 | chunk | 4 | 18.0 | 11.4 | 2.1 | 1.9 | 19.5 | 15i4 | chunk | | 1 | |
| 15i5 | chunk | 2 | 2 | 100.0 | 15i5 | chunk | 2 | 22.6 | 21.0 | 4.7 | 0.4 | 4.2 | 15i5 | chunk | | 1 | |
| 15i6 | chunk | 1 | 1 | 100.0 | 15i6 | chunk | 2 | 25.0 | 19.7 | 4.9 | 0.4 | 4.1 | 15i6 | chunk | | 1 | |
| 15i7 | chunk | 3 | 3 | 100.0 | 15i7 | chunk | 5 | 52.8 | 27.4 | 14.5 | 0.3 | 3.5 | 15i7 | chunk | | 1 | |
| 15i8 | chunk | 4 | 4 | 100.0 | 15i8 | chunk | 8 | 53.0 | 21.3 | 11.3 | 0.7 | 7.1 | 15i8 | chunk | | 1 | |
| 15i9 | chunk | 4 | 4 | 100.0 | 15i9 | chunk | 14 | 60.0 | 23.6 | 14.2 | 1.0 | 9.9 | 15i9 | chunk | | 1 | |
| 15i10 | chunk | 1 | 1 | 100.0 | 15i10 | chunk | 10 | 44.8 | 31.0 | 13.9 | 0.7 | 7.2 | 15i10 | chunk | | 1 | |
| 18d1 | flake | 0 | 8 | 0.0 | 18d1 | flake | 3 | 27.4 | 11.5 | 3.2 | 1.0 | 9.5 | 18d1 | flake | | | 1 |
| 18d2 | flake | 0 | 1 | 0.0 | 18d2 | flake | 10 | 33.6 | 24.0 | 8.1 | 1.2 | 12.4 | 18d2 | flake | | | 1 |
| 18d4 | flake | 5 | 16 | 31.3 | 18d4 | flake | 11 | 39.0 | 30.0 | 11.7 | 0.9 | 9.4 | 18d4 | flake | | | 1 |
| 18d5 | core, cent | 10 | 20 | 50.0 | 18d5 | core, cent | 15 | 53.0 | 36.7 | 19.5 | 0.8 | 7.7 | 18d5 | core, cent | | | 1 |
| S18e1 | flake | 2 | 3 | 66.7 | S18e1 | flake | 4 | 18.4 | 9.0 | 1.7 | 2.4 | 24.2 | S18e1 | flake | | | 1 |
| S18e3 | chunk | 4 | 7 | 57.1 | S18e3 | chunk | 4 | 25.0 | 18.0 | 4.5 | 0.9 | 8.9 | S18e3 | chunk | | | 1 |
| S18e4 | chunk | 4 | 7 | 57.1 | S18e4 | chunk | 6 | 29.3 | 11.4 | 3.3 | 1.8 | 18.0 | S18e4 | chunk | | | 1 |
| S18e5 | core, chunk | 6 | 11 | 54.5 | S18e5 | core, chunk | 17 | 42.3 | 35.5 | 15.0 | 1.1 | 11.3 | S18e5 | core, chunk | | | 1 |
| 19d1 | flake | 0 | 5 | 0.0 | 19d1 | flake | 1 | 15.0 | 12.0 | 1.8 | 0.6 | 5.6 | 19d1 | flake | | 1 | |
| 19d2 | flake | 3 | 3 | 100.0 | 19d2 | flake | 5 | 19.0 | 16.4 | 3.1 | 1.6 | 16.0 | 19d2 | flake | | 1 | |
| 19d3 | flake | 2 | 6 | 33.3 | 19d3 | flake | 8 | 23.3 | 22.8 | 5.3 | 1.5 | 15.1 | 19d3 | flake | | 1 | |
| 19d4 | flake | 1 | 1 | 100.0 | 19d4 | flake | 5 | 33.0 | 23.2 | 7.7 | 0.7 | 6.5 | 19d4 | flake | | 1 | |
| 19d6 | flake | 1 | 3 | 33.3 | 19d6 | flake | 15 | 43.0 | 25.0 | 10.8 | 1.4 | 14.0 | 19d6 | flake | | 1 | |
| 19d7 | flake | 4 | 4 | 100.0 | 19d7 | flake | 12 | 42.3 | 36.3 | 15.4 | 0.8 | 7.8 | 19d7 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19d9 | flake | 2 | 2 | 100.0 | 19d9 | flake | 9 | 47.4 | 38.6 | 18.3 | 0.5 | 4.9 | 19d9 | flake | | 1 | |
| 19d10 | core, cent | 20 | 38 | 52.6 | 19d10 | core, cent | 9 | 63.0 | 38.4 | 24.2 | 0.4 | 3.7 | 19d10 | core, cent | | 1 | |
| 17a,b,c1 | flake | 2 | 7 | 28.6 | 17a,b,c1 | flake | 1 | 18.0 | 15.6 | 2.8 | 0.4 | 3.6 | 17a,b,c1 | flake | | | 1 |
| 17a,b,c2 | chunk | 2 | 7 | 28.6 | 17a,b,c2 | chunk | 2 | 21.2 | 12.4 | 2.6 | 0.8 | 7.6 | 17a,b,c2 | chunk | | 1 | |
| 17a,b,c3 | flake | 0 | 1 | 0.0 | 17a,b,c3 | flake | 2 | 23.4 | 19.7 | 4.6 | 0.4 | 4.3 | 17a,b,c3 | flake | | | 1 |
| 17a,b,c4 | flake | 2 | 2 | 100.0 | 17a,b,c4 | flake | 2 | 39.4 | 18.2 | 7.2 | 0.3 | 2.8 | 17a,b,c4 | flake | | | 1 |
| 17a,b,c5 | chunk | 10 | 11 | 90.9 | 17a,b,c5 | chunk | 4 | 49.4 | 22.7 | 11.2 | 0.4 | 3.6 | 17a,b,c5 | chunk | | | 1 |
| 17a,b,c6 | chunk | 3 | 5 | 60.0 | 17a,b,c6 | chunk | 3 | 43.7 | 22.8 | 10.0 | 0.3 | 3.0 | 17a,b,c6 | chunk | | 1 | |
| 17a,b,c7 | core, pi | 12 | 16 | 75.0 | 17a,b,c7 | core, pi | 1 | 46.2 | 35.5 | 16.4 | 0.1 | 0.6 | 17a,b,c7 | core, pi | | | 1 |
| 17a,b,c9 | core, cent | 15 | 15 | 100.0 | 17a,b,c9 | core, cent | 2 | 48.0 | 28.2 | 13.5 | 0.1 | 1.5 | 17a,b,c9 | core, cent | | 1 | |
| 17a,b,c10 | core, p | 14 | 19 | 73.7 | 17a,b,c10 | core, p | 2 | 57.5 | 38.8 | 22.3 | 0.1 | 0.9 | 17a,b,c10 | core, p | | | 1 |
| 16a1 | flake | 0 | 4 | 0.0 | 16a1 | flake | 2 | 22.0 | 11.3 | 2.5 | 0.8 | 8.0 | 16a1 | flake | | 1 | |
| 16a2 | chunk | 5 | 6 | 83.3 | 16a2 | chunk | 1 | 20.6 | 16.0 | 3.3 | 0.3 | 3.0 | 16a2 | chunk | | 1 | |
| 16a3 | flake | 5 | 5 | 100.0 | 16a3 | flake | 2 | 22.6 | 21.8 | 4.9 | 0.4 | 4.1 | 16a3 | flake | | 1 | |
| 16a4 | flake | 0 | 4 | 0.0 | 16a4 | flake | 3 | 27.6 | 20.0 | 5.5 | 0.5 | 5.4 | 16a4 | flake | | 1 | |
| 16a5 | flake | 5 | 6 | 83.3 | 16a5 | flake | 3 | 27.0 | 26.0 | 7.0 | 0.4 | 4.3 | 16a5 | flake | | 1 | |
| 16a8 | chunk | 11 | 11 | 100.0 | 16a8 | chunk | 5 | 26.0 | 20.0 | 5.2 | 1.0 | 9.6 | 16a8 | chunk | | 1 | |
| 16a10 | core, cent | 28 | 35 | 80.0 | 16a10 | core, cent | 6 | 53.6 | 38.2 | 20.5 | 0.3 | 2.9 | 16a10 | core, cent | | 1 | |
| 18b1 | chunk | 0 | 7 | 0.0 | 18b1 | chunk | 4 | 14.3 | 14.3 | 2.0 | 2.0 | 19.6 | 18b1 | chunk | | 1 | |
| 18b2 | flake | 0 | 4 | 0.0 | 18b2 | flake | 11 | 22.7 | 16.2 | 3.7 | 3.0 | 29.9 | 18b2 | flake | | 1 | |
| 18b3 | flake | 0 | 6 | 0.0 | 18b3 | flake | 14 | 28.0 | 19.2 | 5.4 | 2.6 | 26.0 | 18b3 | flake | | 1 | |
| 18b4 | flake | 0 | 3 | 0.0 | 18b4 | flake | 14 | 35.8 | 17.8 | 6.4 | 2.2 | 22.0 | 18b4 | flake | | 1 | |
| 18b5 | flake | 4 | 7 | 57.1 | 18b5 | flake | 13 | 35.6 | 24.2 | 8.6 | 1.5 | 15.1 | 18b5 | flake | | 1 | |
| 18b6 | flake | 0 | 4 | 0.0 | 18b6 | flake | 20 | 48.5 | 32.3 | 15.7 | 1.3 | 12.8 | 18b6 | flake | | 1 | |
| 18b7 | flake | 5 | 6 | 83.3 | 18b7 | flake | 23 | 52.2 | 28.0 | 14.6 | 1.6 | 15.7 | 18b7 | flake | | 1 | |
| 18b9 | chopper | 16 | 35 | 45.7 | 18b9 | chopper | 14 | 23.4 | 33.3 | 7.8 | 1.8 | 18.0 | 18b9 | chopper | | 1 | |
| 18b10 | handaxe | 22 | 49 | 44.9 | 18b10 | handaxe | 18 | 49.0 | 24.8 | 12.2 | 1.5 | 14.8 | 18b10 | handaxe | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15a1 | flake | 5 | 5 | 100.0 | 15a1 | flake | 2 | 22.8 | 17.0 | 3.9 | 0.5 | 5.2 | 15a1 | flake | | 1 | |
| 15a2 | flake | 0 | 7 | 0.0 | 15a2 | flake | 3 | 28.8 | 25.0 | 7.2 | 0.4 | 4.2 | 15a2 | flake | | 1 | |
| 15a5 | flake | 4 | 6 | 66.7 | 15a5 | flake | 3 | 48.0 | 44.0 | 21.1 | 0.1 | 1.4 | 15a5 | flake | | 1 | |
| 15a7 | flake | 6 | 17 | 35.3 | 15a7 | flake | 3 | 75.0 | 43.4 | 32.6 | 0.1 | 0.9 | 15a7 | flake | | 1 | |
| 15a8 | flake | 4 | 18 | 22.2 | 15a8 | flake | 4 | 65.6 | 58.2 | 38.2 | 0.1 | 1.0 | 15a8 | flake | | 1 | |
| 15a9 | handaxe | 1 | 43 | 2.3 | 15a9 | handaxe | 6 | 49.4 | 28.2 | 13.9 | 0.4 | 4.3 | 15a9 | handaxe | | 1 | |
| 15a10 | chopper | 30 | 50 | 60.0 | 15a10 | chopper | 3 | 84.7 | 38.2 | 32.4 | 0.1 | 0.9 | 15a10 | chopper | | 1 | |
| 21a2 | chunk | 4 | 4 | 100.0 | 21a2 | chunk | 1 | 34.4 | 24.4 | 8.4 | 0.1 | 1.2 | 21a2 | chunk | | 1 | |
| 21a3 | flake | 3 | 3 | 100.0 | 21a3 | flake | 0 | 36.5 | 18.4 | 6.7 | 0.0 | 0.0 | 21a3 | flake | | 1 | |
| 21a4 | flake | 1 | 1 | 100.0 | 21a4 | flake | 1 | 42.8 | 16.0 | 6.8 | 0.1 | 1.5 | 21a4 | flake | | 1 | |
| 21a5 | flake | 5 | 5 | 100.0 | 21a5 | flake | 4 | 33.0 | 31.0 | 10.2 | 0.4 | 3.9 | 21a5 | flake | | 1 | |
| 21a6 | flake | 1 | 2 | 50.0 | 21a6 | flake | 4 | 45.6 | 34.8 | 15.9 | 0.3 | 2.5 | 21a6 | flake | | 1 | |
| 21a7 | core, frag | 6 | 6 | 100.0 | 21a7 | core, frag | 5 | 40.0 | 27.8 | 11.1 | 0.4 | 4.5 | 21a7 | core, frag | | 1 | |
| 21a8 | chopper | 9 | 12 | 75.0 | 21a8 | chopper | 2 | 25.0 | 25.0 | 6.3 | 0.3 | 3.2 | 21a8 | chopper | | 1 | |
| 21a9 | flake | 4 | 4 | 100.0 | 21a9 | flake | 15 | 69.2 | 53.0 | 36.7 | 0.4 | 4.1 | 21a9 | flake | | 1 | |
| 21a10 | flake | 2 | 2 | 100.0 | 21a10 | flake | 15 | 61.3 | 59.0 | 36.2 | 0.4 | 4.1 | 21a10 | flake | | 1 | |
| S21e1 | flake | 1 | 2 | 50.0 | S21e1 | flake | 1 | 26.5 | 17.8 | 4.7 | 0.2 | 2.1 | S21e1 | flake | | | 1 |
| S21e2 | flake | 2 | 3 | 66.7 | S21e2 | flake | 2 | 46.7 | 28.0 | 13.1 | 0.2 | 1.5 | S21e2 | flake | | 1 | |
| S21e4 | flake | 3 | 4 | 75.0 | S21e4 | flake | 4 | 55.5 | 39.4 | 21.9 | 0.2 | 1.8 | S21e4 | flake | | 1 | |
| S21e5 | core, p | 10 | 29 | 34.5 | S21e5 | core, p | 2 | 69.0 | 39.0 | 26.9 | 0.1 | 0.7 | S21e5 | core, p | | 1 | |
| 21r1 | bip flake | 2 | 3 | 66.7 | 21r1 | bip flake | 1 | 22.6 | 7.8 | 1.8 | 0.6 | 5.7 | 21r1 | bip flake | | | 1 |
| 21r2 | bip flake | 3 | 3 | 100.0 | 21r2 | bip flake | 2 | 24.3 | 15.3 | 3.7 | 0.5 | 5.4 | 21r2 | bip flake | | | 1 |
| 21r3 | bip flake | 4 | 5 | 80.0 | 21r3 | bip flake | 1 | 36.6 | 15.2 | 5.6 | 0.2 | 1.8 | 21r3 | bip flake | | | 1 |
| 21r4 | bip flake | 3 | 4 | 75.0 | 21r4 | bip flake | 3 | 41.4 | 19.5 | 8.1 | 0.4 | 3.7 | 21r4 | bip flake | | | 1 |
| 21r5 | bip flake | 2 | 4 | 50.0 | 21r5 | bip flake | 4 | 43.7 | 19.6 | 8.6 | 0.5 | 4.7 | 21r5 | bip flake | | | 1 |
| 21k1 | flake | 1 | 5 | 20.0 | 21k1 | flake | 0 | 22.7 | 14.8 | 3.4 | 0.0 | 0.0 | 21k1 | flake | | 1 | |
| 21k2 | flake | 1 | 3 | 33.3 | 21k2 | flake | 0 | 31.2 | 17.0 | 5.3 | 0.0 | 0.0 | 21k2 | flake | | 1 | |
| 21k3 | flake | 1 | 1 | 100.0 | 21k3 | flake | 2 | 28.2 | 24.7 | 7.0 | 0.3 | 2.9 | 21k3 | flake | | 1 | |
| 21k4 | flake | 4 | 6 | 66.7 | 21k4 | flake | 1 | 29.7 | 27.5 | 8.2 | 0.1 | 1.2 | 21k4 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21k5 | flake | 4 | 8 | 50.0 | 21k5 | flake | 1 | 38.7 | 22.5 | 8.7 | 0.1 | 1.1 | 21k5 | flake | | 1 | |
| 21k6 | flake | 3 | 3 | 100.0 | 21k6 | flake | 1 | 36.4 | 24.5 | 8.9 | 0.1 | 1.1 | 21k6 | flake | | 1 | |
| 21k7 | flake | 1 | 1 | 100.0 | 21k7 | flake | 1 | 43.3 | 27.8 | 12.0 | 0.1 | 0.8 | 21k7 | flake | | 1 | |
| 21k8 | chunk | 4 | 8 | 50.0 | 21k8 | chunk | 2 | 29.0 | 22.0 | 6.4 | 0.3 | 3.1 | 21k8 | chunk | | 1 | |
| 21k10 | chopper/ cent core | 9 | 26 | 34.6 | 21k10 | chopper/ cent core | 1 | 45.0 | 27.6 | 12.4 | 0.1 | 0.8 | 21k10 | chopper/ cent core | | 1 | |
| 6h1 | flake | 1 | 8 | 12.5 | 6h1 | flake | 0 | 40.5 | 30.0 | 12.2 | 0.0 | 0.0 | 6h1 | flake | | 1 | |
| 6h2 | flake | 3 | 3 | 100.0 | 6h2 | flake | 2 | 48.4 | 38.0 | 18.4 | 0.1 | 1.1 | 6h2 | flake | | 1 | |
| 6h4 | core, cent | 10 | 27 | 37.0 | 6h4 | core, cent | 5 | 62.8 | 39.7 | 24.9 | 0.2 | 2.0 | 6h4 | core, cent | | 1 | |
| 6h5 | core, p | 4 | 30 | 13.3 | 6h5 | core, p | 1 | 49.8 | 39.3 | 19.6 | 0.1 | 0.5 | 6h5 | core, p | | 1 | |
| 8p2 | flake | 2 | 3 | 66.7 | 8p2 | flake | 2 | 34.3 | 23.3 | 8.0 | 0.3 | 2.5 | 8p2 | flake | | 1 | |
| 8p3 | flake | 1 | 2 | 50.0 | 8p3 | flake | 7 | 38.7 | 35.6 | 13.8 | 0.5 | 5.1 | 8p3 | flake | | 1 | |
| 8p4 | chunk | 4 | 7 | 57.1 | 8p4 | chunk | 5 | 37.3 | 23.0 | 8.6 | 0.6 | 5.8 | 8p4 | chunk | | 1 | |
| 8p5 | core, pi | 4 | 14 | 28.6 | 8p5 | core, pi | 3 | 42.2 | 25.4 | 10.7 | 0.3 | 2.8 | 8p5 | core, pi | | 1 | |
| 10s1 | flake | 2 | 2 | 100.0 | 10s1 | flake | 1 | 18.0 | 16.6 | 3.0 | 0.3 | 3.3 | 10s1 | flake | | 1 | |
| 10s3 | flake | 1 | 2 | 50.0 | 10s3 | flake | 6 | 23.0 | 22.4 | 5.2 | 1.2 | 11.6 | 10s3 | flake | | 1 | |
| 10s4 | flake | 5 | 6 | 83.3 | 10s4 | flake | 10 | 25.0 | 17.6 | 4.4 | 2.3 | 22.7 | 10s4 | flake | | 1 | |
| 10s5 | flake | 3 | 4 | 75.0 | 10s5 | flake | 15 | 27.0 | 25.6 | 6.9 | 2.2 | 21.7 | 10s5 | flake | | 1 | |
| 10s6 | retouch | 4 | 9 | 44.4 | 10s6 | retouch | 12 | 37.2 | 28.0 | 10.4 | 1.2 | 11.5 | 10s6 | retouch | | 1 | |
| 10s8 | flake | 2 | 2 | 100.0 | 10s8 | flake | 14 | 41.7 | 29.0 | 12.1 | 1.2 | 11.6 | 10s8 | flake | | 1 | |
| 10s9 | core, pi | 5 | 13 | 38.5 | 10s9 | core, pi | 9 | 22.0 | 19.8 | 4.4 | 2.1 | 20.7 | 10s9 | core, pi | | 1 | |
| 10s10 | core, pi | 4 | 15 | 26.7 | 10s10 | core, pi | 11 | 33.4 | 32.6 | 10.9 | 1.0 | 10.1 | 10s10 | core, pi | | 1 | |
| 14b2 | handaxe | 8 | 42 | 19.0 | 14b2 | handaxe | 2 | 66.7 | 48.0 | 32.0 | 0.1 | 0.6 | 14b2 | handaxe | | 1 | |
| 14b3 | core, flat/p | 14 | 26 | 53.8 | 14b3 | core, flat/p | 2 | 57.0 | 49.7 | 28.3 | 0.1 | 0.7 | 14b3 | core, flat/p | | 1 | |
| 14r1 | flake | 2 | 2 | 100.0 | 14r1 | flake | 1 | 21.8 | 16.7 | 3.6 | 0.3 | 2.7 | 14r1 | flake | | | 1 |
| 14r2 | flake | 3 | 4 | 75.0 | 14r2 | flake | 4 | 29.0 | 21.8 | 6.3 | 0.6 | 6.3 | 14r2 | flake | | | 1 |
| 14r3 | core, casual | 5 | 5 | 100.0 | 14r3 | core, casual | 3 | 48.5 | 31.0 | 15.0 | 0.2 | 2.0 | 14r3 | core, casual | | 1 | |
| 20af1 | flake | 6 | 6 | 100.0 | 20af1 | flake | 2 | 20.0 | 16.2 | 3.2 | 0.6 | 6.2 | 20af1 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S5edug1 | retouch | 1 | 6 | 16.7 | S5edug1 | retouch | 1 | 21.4 | 19.5 | 4.2 | 0.2 | 2.4 | S5edug1 | retouch | | | 1 |
| S5edug2 | core, casual | 2 | 4 | 50.0 | S5edug2 | core, casual | 1 | 32.0 | 32.0 | 10.2 | 0.1 | 1.0 | S5edug2 | core, casual | | 1 | |
| 34b1 | chunk | 2 | 7 | 28.6 | 34b1 | chunk | 2 | 22.4 | 15.8 | 3.5 | 0.6 | 5.7 | 34b1 | chunk | | 1 | |
| 34b3 | core, p | 7 | 13 | 53.8 | 34b3 | core, p | 3 | 44.7 | 41.5 | 18.6 | 0.2 | 1.6 | 34b3 | core, p | | 1 | |
| 10L1 | flake | 3 | 3 | 100.0 | 10L1 | flake | 5 | 27.4 | 24.0 | 6.6 | 0.8 | 7.6 | 10L1 | flake | | 1 | |
| 10L2 | core, pi | 16 | 20 | 80.0 | 10L2 | core, pi | 11 | 38.0 | 31.5 | 12.0 | 0.9 | 9.2 | 10L2 | core, pi | | 1 | |
| 10r3 | core, pi | 4 | 13 | 30.8 | 10r3 | core, pi | 2 | 40.0 | 29.5 | 11.8 | 0.2 | 1.7 | 10r3 | core, pi | | 1 | |
| 10v2 | core, pi | 12 | 28 | 42.9 | 10v2 | core, pi | 3 | 40.5 | 36.0 | 14.6 | 0.2 | 2.1 | 10v2 | core, pi | | 1 | |
| 5kdug1 | flake | 3 | 12 | 25.0 | 5kdug1 | flake | 1 | 20.0 | 18.6 | 3.7 | 0.3 | 2.7 | 5kdug1 | flake | | 1 | |
| 5kdug3 | flake | 2 | 2 | 100.0 | 5kdug3 | flake | 4 | 45.3 | 26.0 | 11.8 | 0.3 | 3.4 | 5kdug3 | flake | | 1 | |
| 14m1 | flake | 3 | 4 | 75.0 | 14m1 | flake | 3 | 37.3 | 25.2 | 9.4 | 0.3 | 3.2 | 14m1 | flake | | 1 | |
| 14m2 | chunk | 4 | 12 | 33.3 | 14m2 | chunk | 3 | 56.8 | 27.8 | 15.8 | 0.2 | 1.9 | 14m2 | chunk | | 1 | |
| 34a1 | flake | 2 | 2 | 100.0 | 34a1 | flake | 7 | 31.8 | 17.0 | 5.4 | 1.3 | 12.9 | 34a1 | flake | | 1 | |
| 34a2 | flake | 3 | 10 | 30.0 | 34a2 | flake | 3 | 30.0 | 20.0 | 6.0 | 0.5 | 5.0 | 34a2 | flake | | 1 | |
| 34a3 | core, p | 3 | 16 | 18.8 | 34a3 | core, p | 1 | 37.0 | 33.6 | 12.4 | 0.1 | 0.8 | 34a3 | core, p | | 1 | |
| 10h1 | flake | 3 | 8 | 37.5 | 10h1 | flake | 1 | 25.3 | 19.2 | 4.9 | 0.2 | 2.1 | 10h1 | flake | | 1 | |
| 10h3 | flake | 3 | 8 | 37.5 | 10h3 | flake | 7 | 25.8 | 23.6 | 6.1 | 1.1 | 11.5 | 10h3 | flake | | 1 | |
| 10h4 | flake | 3 | 9 | 33.3 | 10h4 | flake | 9 | 28.0 | 21.3 | 6.0 | 1.5 | 15.1 | 10h4 | flake | | 1 | |
| 10h5 | flake | 5 | 5 | 100.0 | 10h5 | flake | 12 | 34.3 | 26.3 | 9.0 | 1.3 | 13.3 | 10h5 | flake | | 1 | |
| 10h6 | flake | 4 | 6 | 66.7 | 10h6 | flake | 12 | 40.7 | 26.0 | 10.6 | 1.1 | 11.3 | 10h6 | flake | | 1 | |
| 10h8 | chunk | 9 | 18 | 50.0 | 10h8 | chunk | 13 | 40.0 | 41.7 | 16.7 | 0.8 | 7.8 | 10h8 | chunk | | 1 | |
| 10h9 | core, p | 9 | 27 | 33.3 | 10h9 | core, p | 19 | 28.2 | 27.8 | 7.8 | 2.4 | 24.2 | 10h9 | core, p | | 1 | |
| 10h10 | core, p | 11 | 23 | 47.8 | 10h10 | core, p | 22 | 39.8 | 33.2 | 13.2 | 1.7 | 16.6 | 10h10 | core, p | | 1 | |
| 14L1 | flake | 2 | 2 | 100.0 | 14L1 | flake | 4 | 57.0 | 28.2 | 16.1 | 0.2 | 2.5 | 14L1 | flake | | 1 | |
| 14L2 | core, cent | 12 | 23 | 52.2 | 14L2 | core, cent | 19 | 68.0 | 51.0 | 34.7 | 0.5 | 5.5 | 14L2 | core, cent | | 1 | |
| 8q1 | flake | 5 | 6 | 83.3 | 8q1 | flake | 3 | 26.0 | 18.0 | 4.7 | 0.6 | 6.4 | 8q1 | flake | | 1 | |
| 8q2 | flake | 2 | 2 | 100.0 | 8q2 | flake | 5 | 28.7 | 28.6 | 8.2 | 0.6 | 6.1 | 8q2 | flake | | 1 | |
| 8t1 | flake | 1 | 7 | 14.3 | 8t1 | flake | 3 | 33.0 | 22.8 | 7.5 | 0.4 | 4.0 | 8t1 | flake | | 1 | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6g1 | core, p | 6 | 11 | 54.5 | 6g1 | core, p | 1 | 30.3 | 21.3 | 6.5 | 0.2 | 1.5 | 6g1 | core, p | | 1 | |
| 8u2 | core, pi | 15 | 18 | 83.3 | 8u2 | core, pi | 18 | 72.4 | 39.4 | 28.5 | 0.6 | 6.3 | 8u2 | core, pi | | 1 | |
| 8w1 | flake | 0 | 10 | 0.0 | 8w1 | flake | 0 | 28.2 | 26.8 | 7.6 | 0.0 | 0.0 | 8w1 | flake | 1 | | |
| 8w3 | flake | 3 | 5 | 60.0 | 8w3 | flake | 4 | 45.4 | 23.0 | 10.4 | 0.4 | 3.8 | 8w3 | flake | | 1 | |
| 8w8 | flake | 1 | 8 | 12.5 | 8w8 | flake | 1 | 43.0 | 37.0 | 15.9 | 0.1 | 0.6 | 8w8 | flake | | 1 | |
| 8w9 | handaxe | 7 | 45 | 15.6 | 8w9 | handaxe | 1 | 55.0 | 46.0 | 25.3 | 0.0 | 0.4 | 8w9 | handaxe | | 1 | |
| 8w10 | core, cent | 12 | 28 | 42.9 | 8w10 | core, cent | 3 | 68.6 | 64.7 | 44.4 | 0.1 | 0.7 | 8w10 | core, cent | | 1 | |
| 11b1 | flake | 8 | 11 | 72.7 | 11b1 | flake | 3 | 41.8 | 36.6 | 15.3 | 0.2 | 2.0 | 11b1 | flake | | | 1 |
| 11b2 | flake | 7 | 13 | 53.8 | 11b2 | flake | 1 | 48.0 | 35.0 | 16.8 | 0.1 | 0.6 | 11b2 | flake | | | 1 |
| 11b4 | core, cent | 9 | 19 | 47.4 | 11b4 | core, cent | 2 | 56.4 | 44.2 | 24.9 | 0.1 | 0.8 | 11b4 | core, cent | | 1 | |
| 8r1 | flake | 3 | 4 | 75.0 | 8r1 | flake | 1 | 23.0 | 17.8 | 4.1 | 0.2 | 2.4 | 8r1 | flake | | 1 | |
| 8r2 | flake | 3 | 5 | 60.0 | 8r2 | flake | 1 | 29.2 | 19.0 | 5.5 | 0.2 | 1.8 | 8r2 | flake | | 1 | |
| 8s2 | flake | 5 | 11 | 45.5 | 8s2 | flake | 4 | 29.0 | 26.0 | 7.5 | 0.5 | 5.3 | 8s2 | flake | | 1 | |
| 32a1 | flake | 3 | 3 | 100.0 | 32a1 | flake | 4 | 21.5 | 18.5 | 4.0 | 1.0 | 10.1 | 32a1 | flake | | | 1 |
| 32a2 | flake | 1 | 1 | 100.0 | 32a2 | flake | 7 | 30.5 | 23.3 | 7.1 | 1.0 | 9.9 | 32a2 | flake | | | 1 |
| 32a3 | flake | 5 | 6 | 83.3 | 32a3 | flake | 3 | 30.4 | 22.7 | 6.9 | 0.4 | 4.3 | 32a3 | flake | | | 1 |
| 32a5 | core, p | 25 | 29 | 86.2 | 32a5 | core, p | 20 | 37.5 | 36.8 | 13.8 | 1.4 | 14.5 | 32a5 | core, p | | | 1 |
| 14k1 | flake | 5 | 5 | 100.0 | 14k1 | flake | 4 | 25.7 | 21.0 | 5.4 | 0.7 | 7.4 | 14k1 | flake | | | 1 |
| 14k2 | flake | 3 | 3 | 100.0 | 14k2 | flake | 4 | 26.0 | 19.8 | 5.1 | 0.8 | 7.8 | 14k2 | flake | | | 1 |
| 14k3 | flake | 2 | 2 | 100.0 | 14k3 | flake | 8 | 35.3 | 23.6 | 8.3 | 1.0 | 9.6 | 14k3 | flake | | | 1 |
| 14k5 | core, p | 14 | 15 | 93.3 | 14k5 | core, p | 5 | 66.8 | 51.6 | 34.5 | 0.1 | 1.5 | 14k5 | core, p | | | 1 |
| 5bdug1 | flake | 3 | 4 | 75.0 | 5bdug1 | flake | 0 | 22.0 | 8.3 | 1.8 | 0.0 | 0.0 | 5bdug1 | flake | | | 1 |
| 5bdug2 | flake | 1 | 1 | 100.0 | 5bdug2 | flake | 6 | 17.3 | 13.7 | 2.4 | 2.5 | 25.3 | 5bdug2 | flake | | | 1 |
| 5bdug3 | flake | 0 | 2 | 0.0 | 5bdug3 | flake | 0 | 20.8 | 7.6 | 1.6 | 0.0 | 0.0 | 5bdug3 | flake | | | 1 |
| 5bdug4 | flake | 2 | 2 | 100.0 | 5bdug4 | flake | 2 | 25.2 | 11.1 | 2.8 | 0.7 | 7.2 | 5bdug4 | flake | | | 1 |
| 5bdug5 | flake | 6 | 7 | 85.7 | 5bdug5 | flake | 2 | 25.0 | 15.8 | 4.0 | 0.5 | 5.1 | 5bdug5 | flake | | | 1 |
| 5bdug6 | flake | 3 | 3 | 100.0 | 5bdug6 | flake | 7 | 19.3 | 19.2 | 3.7 | 1.9 | 18.9 | 5bdug6 | flake | | | 1 |
| 5bdug10 | core, | 4 | 8 | 50.0 | 5bdug10 | core, | 7 | 40.5 | 38.8 | 15.7 | 0.4 | 4.5 | 5bdug10 | core, | | | 1 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | casual | | | | | casual | | | | | | | | casual | | | |
| 5csurf3 | core, p | 9 | 16 | 56.3 | 5csurf3 | core, p | 5 | 47.0 | 41.7 | 19.6 | 0.3 | 2.6 | 5csurf3 | core, p | | | 1 |
| 5csurf4 | flake | 2 | 3 | 66.7 | 5csurf4 | flake | 3 | 65.3 | 28.0 | 18.3 | 0.2 | 1.6 | 5csurf4 | flake | | | 1 |
| 5csurf5 | flake | 4 | 6 | 66.7 | 5csurf5 | flake | 4 | 53.0 | 44.4 | 23.5 | 0.2 | 1.7 | 5csurf5 | flake | | | 1 |
| 13a1 | flake | 1 | 1 | 100.0 | 13a1 | flake | 3 | 32.0 | 18.0 | 5.8 | 0.5 | 5.2 | 13a1 | flake | | | 1 |
| 13a3 | flake | 4 | 4 | 100.0 | 13a3 | flake | 2 | 31.8 | 28.0 | 8.9 | 0.2 | 2.2 | 13a3 | flake | | | 1 |
| 13a5 | flake | 1 | 1 | 100.0 | 13a5 | flake | 3 | 41.6 | 25.5 | 10.6 | 0.3 | 2.8 | 13a5 | flake | | | 1 |
| 10m1 | flake | 1 | 5 | 20.0 | 10m1 | flake | 0 | 17.7 | 13.8 | 2.4 | 0.0 | 0.0 | 10m1 | flake | | 1 | |
| 10m2 | flake | 1 | 5 | 20.0 | 10m2 | flake | 1 | 24.7 | 10.5 | 2.6 | 0.4 | 3.9 | 10m2 | flake | | 1 | |
| 10m3 | flake | 4 | 6 | 66.7 | 10m3 | flake | 0 | 29.5 | 15.0 | 4.4 | 0.0 | 0.0 | 10m3 | flake | | 1 | |
| 10m5 | flake | 3 | 3 | 100.0 | 10m5 | flake | 3 | 27.7 | 16.3 | 4.5 | 0.7 | 6.6 | 10m5 | flake | | 1 | |
| 10m6 | flake | 5 | 5 | 100.0 | 10m6 | flake | 2 | 27.0 | 22.5 | 6.1 | 0.3 | 3.3 | 10m6 | flake | | 1 | |
| 10m7 | flake | 3 | 6 | 50.0 | 10m7 | flake | 1 | 38.0 | 22.5 | 8.6 | 0.1 | 1.2 | 10m7 | flake | | 1 | |
| 10m9 | flake | 1 | 1 | 100.0 | 10m9 | flake | 4 | 43.2 | 27.6 | 11.9 | 0.3 | 3.4 | 10m9 | flake | | 1 | |
| 10m10 | core, p | 14 | 23 | 60.9 | 10m10 | core, p | 5 | 42.3 | 31.7 | 13.4 | 0.4 | 3.7 | 10m10 | core, p | | 1 | |
| 11a2 | flake | 1 | 1 | 100.0 | 11a2 | flake | 5 | 29.7 | 20.7 | 6.1 | 0.8 | 8.1 | 11a2 | flake | | 1 | |
| 11a3 | flake | 3 | 3 | 100.0 | 11a3 | flake | 4 | 31.0 | 27.7 | 8.6 | 0.5 | 4.7 | 11a3 | flake | | | 1 |
| 11a4 | flake | 6 | 9 | 66.7 | 11a4 | flake | 5 | 28.9 | 26.8 | 7.7 | 0.6 | 6.5 | 11a4 | flake | | | 1 |
| 11a6 | flake | 11 | 11 | 100.0 | 11a6 | flake | 11 | 24.0 | 15.2 | 3.6 | 3.0 | 30.2 | 11a6 | flake | | 1 | |
| 11a8 | core, pi | 23 | 24 | 95.8 | 11a8 | core, pi | 10 | 22.7 | 20.7 | 4.7 | 2.1 | 21.3 | 11a8 | core, pi | | 1 | |
| 11a9 | core, flat | 20 | 20 | 100.0 | 11a9 | core, flat | 8 | 38.6 | 19.2 | 7.4 | 1.1 | 10.8 | 11a9 | core, flat | | 1 | |
| 11a10 | chopper | 19 | 26 | 73.1 | 11a10 | chopper | 6 | 18.6 | 17.1 | 3.2 | 1.9 | 18.9 | 11a10 | chopper | | 1 | |
| 8x1 | flake | 4 | 4 | 100.0 | 8x1 | flake | 2 | 18.0 | 11.7 | 2.1 | 0.9 | 9.5 | 8x1 | flake | | 1 | |
| 8x2 | flake | 4 | 4 | 100.0 | 8x2 | flake | 1 | 19.8 | 10.7 | 2.1 | 0.5 | 4.7 | 8x2 | flake | | 1 | |
| 8x3 | flake | 4 | 4 | 100.0 | 8x3 | flake | 3 | 29.0 | 20.8 | 6.0 | 0.5 | 5.0 | 8x3 | flake | | 1 | |
| 8x4 | chunk | 5 | 5 | 100.0 | 8x4 | chunk | 3 | 34.1 | 28.5 | 9.7 | 0.3 | 3.1 | 8x4 | chunk | | 1 | |
| 8x5 | chunk | 5 | 6 | 83.3 | 8x5 | chunk | 3 | 38.4 | 25.9 | 9.9 | 0.3 | 3.0 | 8x5 | chunk | | 1 | |
| 8x6 | flake | 5 | 5 | 100.0 | 8x6 | flake | 2 | 40.6 | 31.0 | 12.6 | 0.2 | 1.6 | 8x6 | flake | | | 1 |
| 8x7 | core, | 11 | 14 | 78.6 | 8x7 | core, | 4 | 40.0 | 30.0 | 12.0 | 0.3 | 3.3 | 8x7 | core, | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | casual | | | | | casual | | | | | | | | casual | | | |
| 8x8 | core, frag | 5 | 9 | 55.6 | 8x8 | core, frag | 2 | 47.8 | 28.0 | 13.4 | 0.1 | 1.5 | 8x8 | core, frag | | | 1 |
| 8x10 | core, pi | 19 | 19 | 100.0 | 8x10 | core, pi | 4 | 68.0 | 39.2 | 26.7 | 0.2 | 1.5 | 8x10 | core, pi | | 1 | |
| 33b1 | flake | 5 | 6 | 83.3 | 33b1 | flake | 3 | 20.0 | 16.4 | 3.3 | 0.9 | 9.1 | 33b1 | flake | | 1 | |
| 33b3 | flake | 4 | 4 | 100.0 | 33b3 | flake | 5 | 30.0 | 27.2 | 8.2 | 0.6 | 6.1 | 33b3 | flake | | 1 | |
| 33b4 | flake | 4 | 5 | 80.0 | 33b4 | flake | 5 | 38.3 | 9.4 | 3.6 | 1.4 | 13.9 | 33b4 | flake | | 1 | |
| 33b5 | flake | 1 | 1 | 100.0 | 33b5 | flake | 7 | 37.7 | 36.0 | 13.6 | 0.5 | 5.2 | 33b5 | flake | | 1 | |
| 33b7 | flake | 3 | 4 | 75.0 | 33b7 | flake | 7 | 28.8 | 24.6 | 7.1 | 1.0 | 9.9 | 33b7 | flake | | 1 | |
| 33b9 | core, flat | 11 | 16 | 68.8 | 33b9 | core, flat | 5 | 31.8 | 28.0 | 8.9 | 0.6 | 5.6 | 33b9 | core, flat | | 1 | |
| 33b10 | core, flat | 23 | 26 | 88.5 | 33b10 | core, flat | 7 | 33.5 | 29.2 | 9.8 | 0.7 | 7.2 | 33b10 | core, flat | | 1 | |
| 27b1 | flake | 0 | 3 | 0.0 | 27b1 | flake | 0 | 21.0 | 12.5 | 2.6 | 0.0 | 0.0 | 27b1 | flake | 1 | | |
| 27b2 | flake | 2 | 6 | 33.3 | 27b2 | flake | 1 | 25.4 | 20.0 | 5.1 | 0.2 | 2.0 | 27b2 | flake | 1 | | |
| 27b3 | flake | 2 | 11 | 18.2 | 27b3 | flake | 0 | 36.8 | 12.5 | 4.6 | 0.0 | 0.0 | 27b3 | flake | 1 | | |
| 27b4 | flake | 3 | 5 | 60.0 | 27b4 | flake | 1 | 33.0 | 24.2 | 8.0 | 0.1 | 1.3 | 27b4 | flake | 1 | | |
| 27b5 | flake | 1 | 1 | 100.0 | 27b5 | flake | 3 | 56.0 | 16.3 | 9.1 | 0.3 | 3.3 | 27b5 | flake | 1 | | |
| 27b6 | flake | 1 | 11 | 9.1 | 27b6 | flake | 0 | 39.0 | 24.8 | 9.7 | 0.0 | 0.0 | 27b6 | flake | 1 | | |
| 27b8 | flake | 5 | 12 | 41.7 | 27b8 | flake | 3 | 63.5 | 41.3 | 26.2 | 0.1 | 1.1 | 27b8 | flake | 1 | | |
| 27b10 | handaxe | 17 | 41 | 41.5 | 27b10 | handaxe | 1 | 83.0 | 55.5 | 46.1 | 0.0 | 0.2 | 27b10 | handaxe | 1 | | |
| 30h1 | cutting | 0 | 22 | 0.0 | 30h1 | cutting | 0 | 40.0 | 22.6 | 9.0 | 0.0 | 0.0 | 30h1 | cutting | | 1 | |
| 30h2 | flake | 1 | 1 | 100.0 | 30h2 | flake | 1 | 45.3 | 34.6 | 15.7 | 0.1 | 0.6 | 30h2 | flake | | 1 | |
| 30k1 | flake | 4 | 8 | 50.0 | 30k1 | flake | 1 | 26.7 | 24.0 | 6.4 | 0.2 | 1.6 | 30k1 | flake | | 1 | |
| 23d2 | flake | 2 | 6 | 33.3 | 23d2 | flake | 2 | 42.6 | 28.4 | 12.1 | 0.2 | 1.7 | 23d2 | flake | | 1 | |
| S30e1 | flake | 3 | 4 | 75.0 | S30e1 | flake | 1 | 22.6 | 21.5 | 4.9 | 0.2 | 2.1 | S30e1 | flake | | 1 | |
| S30e2 | flake | 7 | 7 | 100.0 | S30e2 | flake | 1 | 28.2 | 18.0 | 5.1 | 0.2 | 2.0 | S30e2 | flake | | 1 | |
| S30e3 | flake | 1 | 5 | 20.0 | S30e3 | flake | 1 | 35.0 | 26.8 | 9.4 | 0.1 | 1.1 | S30e3 | flake | | 1 | |
| S30e5 | flake | 7 | 9 | 77.8 | S30e5 | flake | 1 | 43.8 | 30.5 | 13.4 | 0.1 | 0.7 | S30e5 | flake | | 1 | |
| S30e6 | flake | 4 | 5 | 80.0 | S30e6 | flake | 1 | 42.0 | 33.5 | 14.1 | 0.1 | 0.7 | S30e6 | flake | | 1 | |
| S30e7 | core, flat | 14 | 15 | 93.3 | S30e7 | core, flat | 1 | 47.2 | 44.2 | 20.9 | 0.0 | 0.5 | S30e7 | core, flat | | 1 | |
| S30e8 | flake | 10 | 14 | 71.4 | S30e8 | flake | 1 | 45.6 | 42.2 | 19.2 | 0.1 | 0.5 | S30e8 | flake | | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S30e10 | core, cent | 17 | 19 | 89.5 | S30e10 | core, cent | 1 | 45.5 | 45.5 | 20.7 | 0.0 | 0.5 | S30e10 | core, cent | | 1 | |
| 30j1 | flake | 2 | 8 | 25.0 | 30j1 | flake | 1 | 20.0 | 15.5 | 3.1 | 0.3 | 3.2 | 30j1 | flake | | 1 | |
| 30j2 | flake | 9 | 16 | 56.3 | 30j2 | flake | 0 | 28.2 | 24.3 | 6.9 | 0.0 | 0.0 | 30j2 | flake | | 1 | |
| 30j3 | flake | 0 | 1 | 0.0 | 30j3 | flake | 0 | 24.8 | 16.6 | 4.1 | 0.0 | 0.0 | 30j3 | flake | | 1 | |
| 30j4 | chunk | 5 | 7 | 71.4 | 30j4 | chunk | 1 | 29.5 | 23.3 | 6.9 | 0.1 | 1.5 | 30j4 | chunk | | 1 | |
| 30j5 | core, flat | 5 | 10 | 50.0 | 30j5 | core, flat | 1 | 27.0 | 23.0 | 6.2 | 0.2 | 1.6 | 30j5 | core, flat | | 1 | |
| 30i1 | flake | 3 | 5 | 60.0 | 30i1 | flake | 3 | 25.0 | 9.8 | 2.5 | 1.2 | 12.2 | 30i1 | flake | | 1 | |
| 30i3 | cutting | 3 | 8 | 37.5 | 30i3 | cutting | 0 | 29.0 | 15.6 | 4.5 | 0.0 | 0.0 | 30i3 | cutting | | 1 | |
| 30i4 | core, casual | 7 | 14 | 50.0 | 30i4 | core, casual | 1 | 27.0 | 19.7 | 5.3 | 0.2 | 1.9 | 30i4 | core, casual | | 1 | |
| 30i5 | chunk | 6 | 8 | 75.0 | 30i5 | chunk | 2 | 38.0 | 15.0 | 5.7 | 0.4 | 3.5 | 30i5 | chunk | | 1 | |
| | | | | | | | | | | | | | | | | | |
| **n** | | | | **Mean** | **n** | | | | | | | **Mean** | **n** | | | | |
| **366** | | | | 60.9% | **366** | | | | | | | 6.5 | **366** | | 26 | 281 | 59 |
| | | | | | | | | | | | | | | Percentage of sample | 7.1 | 76.8 | 16.1 |

**Table 20: Mann-Whitney test results for IERs**

| SWK vs EXP | Oldowan | quartzite |
|---|---|---|
| A (N=445) vs. B(N=43) | | |
| Mean ranks: | 226.4 | 18.09 |
| T=Ub: | 7.88E+03 | |
| p(same): | 5.50E-02 | |
| Monte Carlo p: | 0.055 | |

| SWK vs EXP | Oldowan | quartz |
|---|---|---|
| D (N=347) vs. E(N=375) | | |
| Mean ranks: | 201.5 | 160 |
| T=Ub: | 4.50E+04 | |
| p(same): | 6.34E-13 | |
| Monte Carlo p: | <0.0001 | |

| SWK vs EXP | Oldowan | chert |
|---|---|---|
| G (N=882) vs. H(N=274) | | |
| Mean ranks: | 472.8 | 105.7 |
| T=Ub: | 8.45E+04 | |
| p(same): | 4.26E-14 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Oldowan | quartzite |
|---|---|---|
| A (N=77) vs. B(N=445) | | |
| Mean ranks: | 24.11 | 237.4 |
| T=Ub: | 9585 | |
| p(same): | 4.93E-10 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Oldowan | quartz |
|---|---|---|
| D (N=347) vs. E(N=157) | | |
| Mean ranks: | 199.8 | 52.7 |
| T=Ub: | 1.42E+04 | |
| p(same): | 3.30E-18 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Oldowan | chert |
|---|---|---|
| G (N=882) vs. H(N=21) | | |
| Mean ranks: | 447.9 | 4.127 |
| T=Ub: | 3496 | |
| p(same): | 9.82E-07 | |
| Monte Carlo p: | <0.0001 | |

| STK vs SWK | Oldowan | quartzite |
|---|---|---|
| A (N=77) vs. B(N=43) | | |
| Mean ranks: | 34.94 | 25.56 |
| T=Ub: | 1190 | |
| p(same): | 7.67E-03 | |
| Monte Carlo p: | 0.0071 | |

| STK vs SWK | Oldowan | quartz |
|---|---|---|
| D (N=157) vs. E(N=375) | | |
| Mean ranks: | 66.61 | 199.9 |
| T=Ub: | 2.30E+04 | |
| p(same): | 5.60E-05 | |
| Monte Carlo p: | <0.0001 | |

| STK vs SWK | Oldowan | chert |
|---|---|---|
| G (N=21) vs. H(N=274) | | |
| Mean ranks: | 7.325 | 140.7 |
| T=Ub: | 1930 | |
| p(same): | 0.01149 | |
| Monte Carlo p: | 0.0088 | |

| SWK vs EXP | Acheulean | quartzite |
|---|---|---|
| A (N=34) vs. B(N=303) | | |
| Mean ranks: | 9.568 | 159.4 |

| SWK vs EXP | Acheulean | quartz |
|---|---|---|
| D (N=18) vs. E(N=174) | | |
| Mean ranks: | 4.576 | 91.92 |

| SWK vs EXP | Acheulean | chert |
|---|---|---|
| G (N=60) vs. H(N=366) | | |
| Mean ranks: | 19.58 | 193.9 |

| | | |
|---|---|---|
| T=Ub: | 2630 | |
| p(same): | 2.45E-06 | |
| Monte Carlo p: | <0.0001 | |

| | | |
|---|---|---|
| T=Ub: | 707.5 | |
| p(same): | 0.000121 | |
| Monte Carlo p: | <0.0001 | |

| | | |
|---|---|---|
| T=Ub: | 6513 | |
| p(same): | 3.32E-07 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Acheulean | quartzite |
|---|---|---|
| J (N=34) vs. K(N=303) | | |
| Mean ranks: | 11.92 | 157.1 |
| T=Ub: | 3424 | |
| p(same): | 0.001248 | |
| Monte Carlo p: | 0.0007 | |

| STK vs EXP | Acheulean | quartz |
|---|---|---|
| M (N=33) vs. N(N=174) | | |
| Mean ranks: | 7.867 | 96.13 |
| T=Ub: | 1068 | |
| p(same): | 8.99E-09 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Acheulean | chert |
|---|---|---|
| n/a STK sample too small | | |

| STK vs SWK | Acheulean | quartzite |
|---|---|---|
| A (N=34) vs. B(N=34) | | |
| Mean ranks: | 18.4 | 16.1 |
| T=Ub: | 500 | |
| p(same): | 0.3295 | |
| Monte Carlo p: | 0.3238 | |

| STK vs SWK | Acheulean | quartz |
|---|---|---|
| A (N=18) vs. B(N=33) | | |
| Mean ranks: | 10.06 | 15.94 |
| T=Ub: | 252 | |
| p(same): | 0.3728 | |
| Monte Carlo p: | 0.3717 | |

| STK vs SWK | Acheulean | chert |
|---|---|---|
| n/a STK sample too small | | |

**Table 21: Mann-Whitney test results for FERs**

| SWK vs EXP | Oldowan | quartz |
|---|---|---|
| A (N=375) vs. B(N=347) | | |
| Mean ranks: | 158.9 | 202.6 |
| T=Ub: | 4.42E+04 | |
| p(same): | 1.02E-13 | |
| Monte Carlo p: | <0.0001 | |

| SWK vs EXP | Oldowan | chert |
|---|---|---|
| D (N=274) vs. E(N=882) | | |
| Mean ranks: | 123 | 455.5 |
| T=Ub: | 1.05E+05 | |
| p(same): | 7.48E-04 | |
| Monte Carlo p: | 0.0005 | |

| STK vs EXP | Oldowan | quartz |
|---|---|---|
| G (N=81) vs. H(N=347) | | |
| Mean ranks: | 26.08 | 188.4 |
| T=Ub: | 7.84E+03 | |
| p(same): | 5.72E-10 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Oldowan | chert |
|---|---|---|
| J (N=20) vs. K(N=882) | | |
| Mean ranks: | 5.16 | 446.3 |
| T=Ub: | 4445 | |
| p(same): | 1.46E-04 | |
| Monte Carlo p: | 0.0001 | |

| STK vs SWK | Oldowan | quartz |
|---|---|---|
| M (N=81) vs. N(N=375) | | |
| Mean ranks: | 34.75 | 193.7 |
| T=Ub: | 1.25E+04 | |
| p(same): | 1.34E-02 | |
| Monte Carlo p: | 0.0144 | |

| STK vs SWK | Oldowan | chert |
|---|---|---|
| P (N=20) vs. Q(N=274) | | |
| Mean ranks: | 6.689 | 140.8 |
| T=Ub: | 1757 | |
| p(same): | 0.00727 | |
| Monte Carlo p: | 0.0074 | |

| SWK vs EXP | Acheulean | quartz |
|---|---|---|
| A (N=18) vs. B(N=174) | | |

| SWK vs EXP | Acheulean | chert |
|---|---|---|
| D (N=60) vs. E(N=366) | | |

| | | |
|---|---|---|
| Mean ranks: | 7.883 | 88.62 |
| T=Ub: | 1343 | |
| p(same): | 0.3204 | |
| Monte Carlo p: | 0.3244 | |

| | | |
|---|---|---|
| Mean ranks: | 30.72 | 182.8 |
| T=Ub: | 1.07E+04 | |
| p(same): | 7.53E-01 | |
| Monte Carlo p: | 0.7566 | |

| STK vs EXP | Acheulean | quartz |
|---|---|---|
| G (N=33) vs. H(N=174) | | |
| Mean ranks: | 10.18 | 93.82 |
| T=Ub: | 1547 | |
| p(same): | 2.72E-05 | |
| Monte Carlo p: | <0.0001 | |

| STK vs EXP | Acheulean | chert |
|---|---|---|
| n/a STK sample too small | | |

| STK vs SWK | Acheulean | quartz |
|---|---|---|
| K (N=18) vs. L(N=33) | | |
| Mean ranks: | 11.92 | 14.08 |
| T=Ub: | 157 | |
| p(same): | 0.005953 | |
| Monte Carlo p: | 0.0046 | |

| STK vs SWK | Acheulean | chert |
|---|---|---|
| n/a STK sample too small | | |

**Table 22: Chi-square test results for weathering distributions**

| STK vs EXP | Oldowan | quartzite | p |
|---|---|---|---|
| 36.4 | 55.8 | 7.8 | 0.000 |
| 13.93258 | 52.35955 | 33.70787 | |
| | | | |
| SWK vs EXP | Oldowan | quartzite | |
| 65.11628 | 30.23256 | 4.651163 | 0.000 |
| 13.93258 | 52.35955 | 33.70787 | |
| | | | |
| STK vs SWK | Oldowan | quartzite | |
| 36.36364 | 55.84416 | 7.792208 | 0.000 |
| 65.11628 | 30.23256 | 4.651163 | |
| | | | |
| SWK vs STK | Oldowan | quartzite | |
| 65.11628 | 30.23256 | 4.651163 | 0.000 |
| 36.36364 | 55.84416 | 7.792208 | |

| STK vs EXP | Oldowan | quartz | p |
|---|---|---|---|
| 88.88889 | 8.641975 | 2.469136 | 0.000 |
| 37.75216 | 47.83862 | 14.40922 | |
| | | | |
| SWK vs EXP | Oldowan | quartz | |
| 71.73333 | 28.26667 | 0 | 0.000 |
| 37.75216 | 47.83862 | 14.40922 | |
| | | | |
| STK vs SWK | Oldowan | quartz | |
| 88.88889 | 8.641975 | 2.469136 | 0.000 |
| 71.73333 | 28.26667 | 0.01 | |
| | | | |
| SWK vs STK | Oldowan | quartz | |
| 71.73333 | 28.26667 | 0 | 0.000 |
| 88.88889 | 8.641975 | 2.469136 | |

| STK vs EXP | Oldowan | chert | p |
|---|---|---|---|
| 30 | 70 | 0 | 0.000 |
| 12.58503 | 72.78912 | 14.62585 | |
| | | | |
| SWK vs EXP | Oldowan | chert | |
| 24.08759 | 74.81752 | 1.094891 | 0.000 |
| 12.58503 | 72.78912 | 14.62585 | |
| | | | |
| STK vs SWK | Oldowan | chert | |
| 30.0 | 70.0 | 0.0 | 0.242 |
| 24.1 | 74.8 | 1.1 | |
| | | | |
| SWK vs STK | Oldowan | chert | |
| 24.1 | 74.8 | 1.1 | 0.000 |
| 30.0 | 70.0 | 0.0 | |

**Table 23: Chi-square test results for weathering distributions**

| STK vs EXP | Acheulean | quartzite | |
|---|---|---|---|
| 67.6 | 29.4 | 2.9 | 0.000 |
| 10.63123 | 51.82724 | 37.54153 | |
| | | | |
| SWK vs EXP | Acheulean | quartzite | |
| 61.76471 | 38.23529 | 0 | 0.000 |
| 10.6 | 51.8 | 37.5 | |
| | | | |
| STK vs SWK | Acheulean | quartzite | |
| 67.6 | 29.4 | 2.9 | 0.000 |
| 61.76471 | 38.23529 | 0.01 | |
| | | | |
| SWK vs STK | Acheulean | quartzite | |
| 61.76471 | 38.23529 | 0.01 | 0.048 |
| 67.6 | 29.4 | 2.9 | |

| STK vs EXP | Acheulean | quartz | |
|---|---|---|---|
| 90.90909 | 9.090909 | 0 | 0.000 |
| 36.2069 | 50 | 13.7931 | |
| | | | |
| SWK vs EXP | Acheulean | quartz | |
| 72.22222 | 27.77778 | 0 | 0.000 |
| 36.2 | 50.0 | 13.8 | |
| | | | |
| STK vs SWK | Acheulean | quartz | |
| 90.90909 | 9.090909 | 0.01 | 0.000 |
| 72.22222 | 27.77778 | 0.01 | |
| | | | |
| SWK vs STK | Acheulean | quartz | |
| 72.22222 | 27.77778 | 0.01 | 0.000 |
| 90.90909 | 9.090909 | 0.01 | |

| STK vs EXP | Acheulean | chert | |
|---|---|---|---|
| n/a | | | |
| | | | |
| | | | |
| SWK vs EXP | Acheulean | chert | |
| 48.33333 | 51.66667 | 0 | 0.000 |
| 7.1 | 76.8 | 16.1 | |
| | | | |
| STK vs SWK | Acheulean | chert | |
| n/a | | | |
| | | | |
| | | | |
| SWK vs STK | Acheulean | chert | |
| n/a | | | |

**Table 24: Chi-square test results for weathering distributions materials combined**

| | | | | |
|---|---|---|---|---|
| STK Oldowan | | | | |
| vs | 52.5 | 46.8 | 0.7225 | 0.000 |
| SWK Oldowan | 59.55056 | 35.95506 | 4.4944 | |
| SWK Oldowan | | | | |
| vs | 59.55056 | 35.95506 | 4.4944 | 0.026 |
| STK Oldowan | 52.5 | 46.8 | 0.7225 | |

| | | | | |
|---|---|---|---|---|
| STK Acheulean | | | | |
| vs | 79.10448 | 19.4 | 1.4925 | 0.000 |
| SWK Acheulean | 56.25 | 43.75 | 0.01 | |
| SWK Acheulean | | | | |
| vs | 56.25 | 43.75 | 0.01 | 0.000 |
| STK Acheulean | 79.10448 | 19.4 | 1.4925 | |

**Table 25: Chi-square test results for weathering distributions Oldowan vs Acheulean**

| STK | Oldowan vs Acheulean | quartzite | p |
|---|---|---|---|
| 36.36364 | 55.84416 | 7.792208 | 0.000 |
| 67.64706 | 29.41176 | 2.941176 | |
| STK | Oldowan vs Acheulean | quartz | |
| 88.88889 | 8.641975 | 2.469136 | 0.281 |
| 90.90909 | 9.090909 | 0 | |
| STK | Oldowan vs Acheulean | all | |
| 63.29114 | 31.64557 | 5.063291 | 0.004 |
| 79.10448 | 19.40299 | 1.492537 | |

| SWK | Oldowan vs Acheulean | quartzite | p |
|---|---|---|---|
| 65.11628 | 30.23256 | 4.651 | 0.031 |
| 61.76471 | 38.23529 | 0 | |
| SWK | Oldowan vs Acheulean | quarts | |
| 71.73333 | 28.26667 | 0.01 | 0.994 |
| 72.22222 | 27.77778 | 0.01 | |
| SWK | Oldowan vs Acheulean | chert | |
| 24.08759 | 74.81752 | 1.095 | 0.000 |
| 48.33333 | 51.66667 | 0 | |
| SWK | Oldowan vs Acheulean | all | |
| 52.45665 | 46.82081 | 0.723 | 0.549 |
| 56.25 | 43.75 | 0 | |

**Table 26: Chi-square test results for grain size distributions**

| Grains | Oldowan | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STK | 2.597403 | 57.14286 | 35.065 | 3.896 | 1.298701 | 0.01 | STK vs EXP | 0.000 | STK Oldowan vs Acheulean | 0.000 |
| SWK | 2.325581 | 48.83721 | 46.512 | 2.326 | 0.01 | 0.01 | SWK vs EXP | 0.000 | SWK Oldowan vs Acheulean | 0.000 |
| EXP | 0.01 | 44.94382 | 37.528 | 12.81 | 2.47191 | 2.247191 | STK vs SWK | 0.000 | | |
| | | | | | | | SWK vs STK | 0.229 | | |
| Grains | Acheulean | | | | | | | | | |
| STK | 11.76471 | 29.41176 | 50 | 8.824 | 0.01 | 0.01 | STK vs EXP | 0.000 | | |
| SWK | 8.823529 | 41.17647 | 44.118 | 2.941 | 2.941176 | 0.01 | SWK vs EXP | 0.000 | | |
| EXP | 0.01 | 44.22442 | 35.644 | 15.51 | 1.980198 | 2.640264 | STK vs SWK | 0.001 | | |
| | | | | | | | SWK vs STK | 0.000 | | |