Early Acheulean in the Vaal River basin, Rietputs Formation, Northern Cape Province, South Africa

George Michael Leader IV

A dissertation submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Master of Science.

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DECLARATION

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

Signed this __________ day of __________ 2009

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George Michael Leader IV

ABSTRACT

The site of Rietputs 15 which is part of the Rietputs Formation, Windsorton, South Africa has yielded the first early Acheulean collection in southern Africa to have an absolute date. Cosmogenic burial dating has provided the site with an age of *ca* 1.60 ± 0.36 Ma, with the collection's individual age of 1.43 ± 0.23 Ma (Gibbon *et al.* 2008). These dates indicate that Rietputs 15 artefacts are some of the oldest Acheulean artefacts in South Africa and places it firmly in the early Acheulean. In addition to the diagnostic bifaces such as handaxes and cleavers, the collection contains a number of highly "organised" cores. Out of all the cores in the collection approximately 5% display a number of features which demonstrate hominids were controlling the working of the core in order to exploit the largest surface, often for a preferential removal. The most common form of organisation is asymmetrical control in which the underside is worked pyramidally so that the larger top surface may be exploited. However, should the largest face be a side of the core accessible with minimal effort, the hominids focused flaking there, producing a single platform core with elongated removals somewhat similar to a blade core. These cores tend to be worked much less on the platform and other sides, suggesting that the blank was carefully selected for its shape. Such early forms of organisation may stem from two factors. First, the hornfels that is most often used is a fine-grained and uniform material which makes for high quality knapping results. Secondly, the hornfels is typically found in "blocky" forms. Such blanks have a number of faces and angles which may assist and even influence the core organisation. Such evidence supports the claim that organized flaking strategies of cores in the early Acheulean needs to be re-evaluated. The reason that these patterns have been recognized in the South African early Acheulean is because of the large sample of provenience-controlled and dated artefacts provided by the Rietputs 15 site. The collection also contains a large number of bifaces that now provide a substantial sample of these diagnostic tool types for a more detailed understanding of the early Acheulean in South Africa.

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This research is dedicated to Frank Broedel. His love for anthropology and archaeology was inspiring and contagious.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The Early Acheulean sites in South Africa which provide datable site contexts are very limited. Most of these sites lie in the Cradle of Humankind in Gauteng Province, with most age estimates based on faunal assemblages (Kuman 2007). In the past the early Acheulean artefacts had not been identified in Vaal River gravels because dating information and provenience-controlled samples were lacking.

It has been apparent for quite some time that modern archaeological techniques and dating methods needed to be applied to the artefacts from the Vaal River basin. For the first half of the century these alluvial gravels and sands were investigated by archaeologists such as C. van Riet Lowe and the Abbé Breuil. These investigations have provided the majority of South Africa's Acheulean collections, but with poor documentation of provenience and poorly recorded localities (Sampson 1972). Many of these artefacts were collected from surface occurrences and disturbed localities (Mitchell 2002).

The collection on which this research will focus comes from the Rietputs Formation in the town of Windsorton, South Africa (Figure 1.1). The actual pit, Pit A, from which the sample was obtained is approximately 1.5 km from the modern Vaal River (Figure 1.2) These gravels around Windsorton were first investigated by C. van Riet Lowe and The Abbé Breuil (van Riet Lowe 1945). Here they collected tools from the dumps of the diamond miners who first established the town (Breuil 1943, 1948).

The stone tools of the Vaal gravels and other interior sites have provided South Africa with the majority of its Acheulean material or "Great Hand-axe Culture" as described by Van Riet Lowe (1948). The stone tools collected at Rietputs 15 include bifaces such as handaxes and cleavers. However, the Vaal collections from the days of van Riet Lowe are largely selected collections. "The most important shortcoming of the Vaal studies is a complete absence of analysis of large, sealed, unselected artefact samples" (Sampson 1972), as only the "finest" specimens were collected (Helgren 1978). A problem with the early Vaal samples is that the depth of the gravel deposits, anywhere between 3 to 20 metres below the surface, makes it difficult for standard archaeological excavation methods. Therefore mining trenches must provide our access to these deposits.

More recently, in 2005 R.J. Gibbon investigated the site for the possibility of applying cosmogenic nuclide burial dating to the stratified layers. An assemblage of 465 Acheulean artefacts was collected by Gibbon as part of his PhD research on stratigraphy and dating of the Rietputs Formation in collaboration with D. Granger and T.C. Partridge (Gibbon 2009). Six samples from the lower coarse alluvium at Windsorton produced an average burial age of 1.57±0.22 Ma, and three samples dated the upper fine alluvium to 1.26±0.10 Ma (Gibbon *et al.* 2009). Samples were dated from a number of different pits across the Rietputs farm, and the distribution of the results has been interpreted to mean that sediment deposition occurred over a time span of several hundred thousand years. The data thus indicate that gravel deposition dominated from *ca* 1.8 to 1.35 Ma, with the mean date for the samples being 1.57±0.22 Ma; the capping fine alluvium was deposited *ca* 1.35 to 1.15, with a mean date of 1.26±0.10 Ma. Additional dates for Rietputs Formation deposits (both up and downstream of Windsorton, and along the right bank tributaries of the Vaal River) provided ages consistent with those at Windsorton.

The major goals of my research project have been to enlarge the well provenanced early Acheulean collections and understand core organisation.

The Cosmogenic Nuclide dating method is based on the relative radioactive decay of ^{26}Al and ^{10} Be produced in quartz grains by cosmic rays before burial. After burial, the quartz is shielded from these rays and subsequently the ^{26}Al and ^{10}Be decay (Granger 2006, Gibbon *et al.* 2009,). These newly applicable dating methods allow the first absolute dates of the sedimentary layers in the ancient gravels. In short, it is now possible to know the exact location of the artefacts collected and to obtain, for the first time, a date on the age and period of time over which the layer accumulated. The Vaal gravels around Windsorton have had a complex and little understood depositional history (du Toit 1948), but Gibbon's (2009) geomorphological study in conjunction with absolute dates (Gibbon *et al.* 2009)_has provided greater clarity. Although the artefacts may have accumulated in the alluvial gravel layer over as much as a 400,000 year span (Gibbon, pers. comm.), their age is no younger than 1.2 Ma. Some exposures also show discontinuous palaeosols throughout the layers above the alluvial gravel. The detailed re-assessment of the Rietputs 15 stratigraphy and geomorphology study by Gibbon, Granger and Partridge has been critical for this project.

This work has also shown that there is virtually no chance of contamination with younger artefacts from overlying fine alluvial sediments because these are largely sterile of cultural material, and thus the dates accurately place the lower alluvium in the early Acheulean period. The collection contains a number of cores with features which would previously have been considered technologically later had they been found out of context--cores which show a significant degree of organization, and in some rare cases, even a degree of preparation. This is the first time these patterns of organisation have been noticed in the early Acheulean of South Africa, which is the result of access to a large amount of gravels with large provenience-controlled collections that have allowed the patterns to be assessed quantitatively. With the massive amount of artefact-bearing gravels along the Vaal, more work needs to be done. This project highlights the importance of continued research on the Vaal alluvial sites.

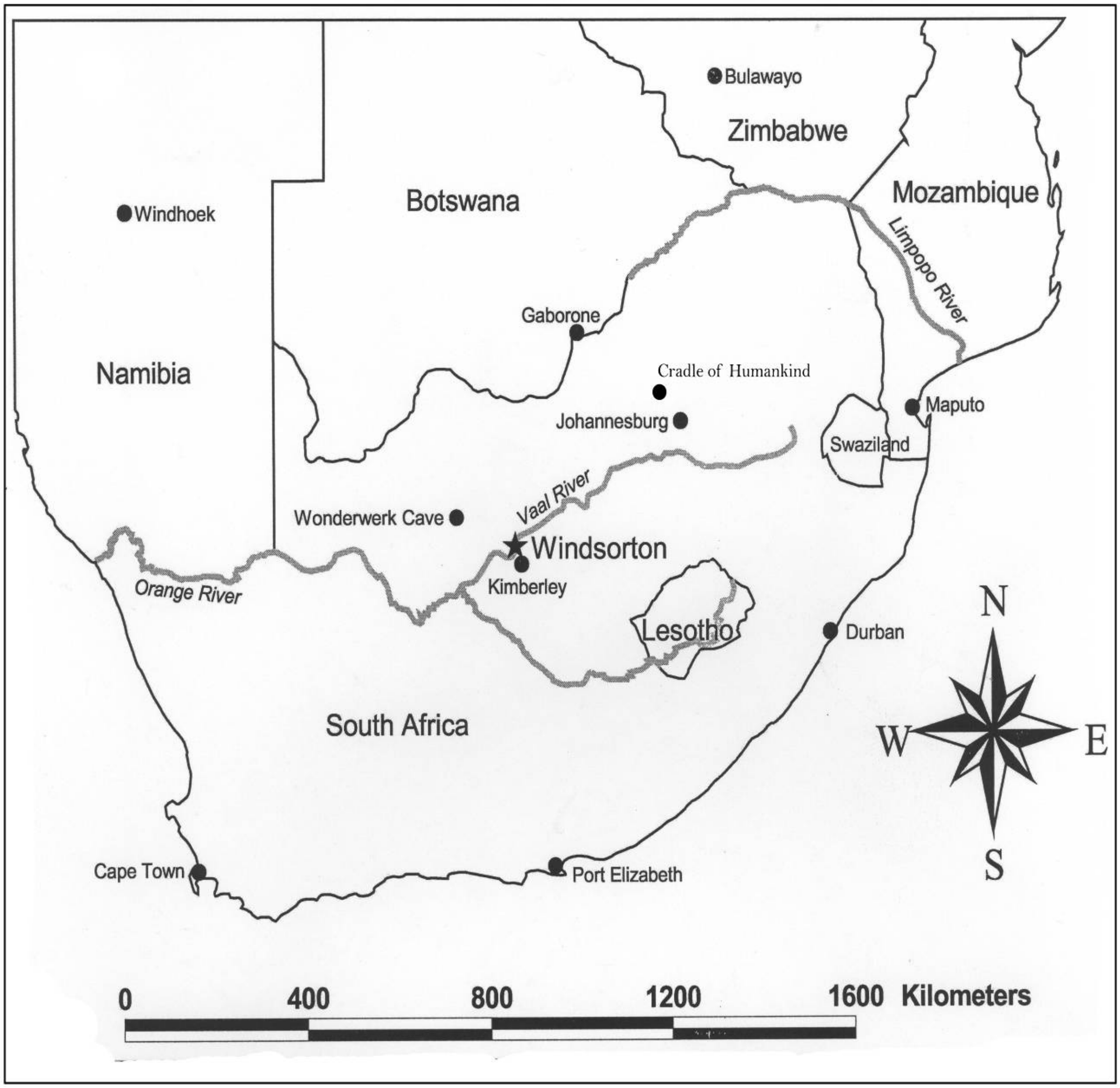

Figure 1.1 Locations of early Acheulean in South Africa. (Courtesy of R.J. Gibbon)

Sites at Rietputs 15, Windsorton, South Africa

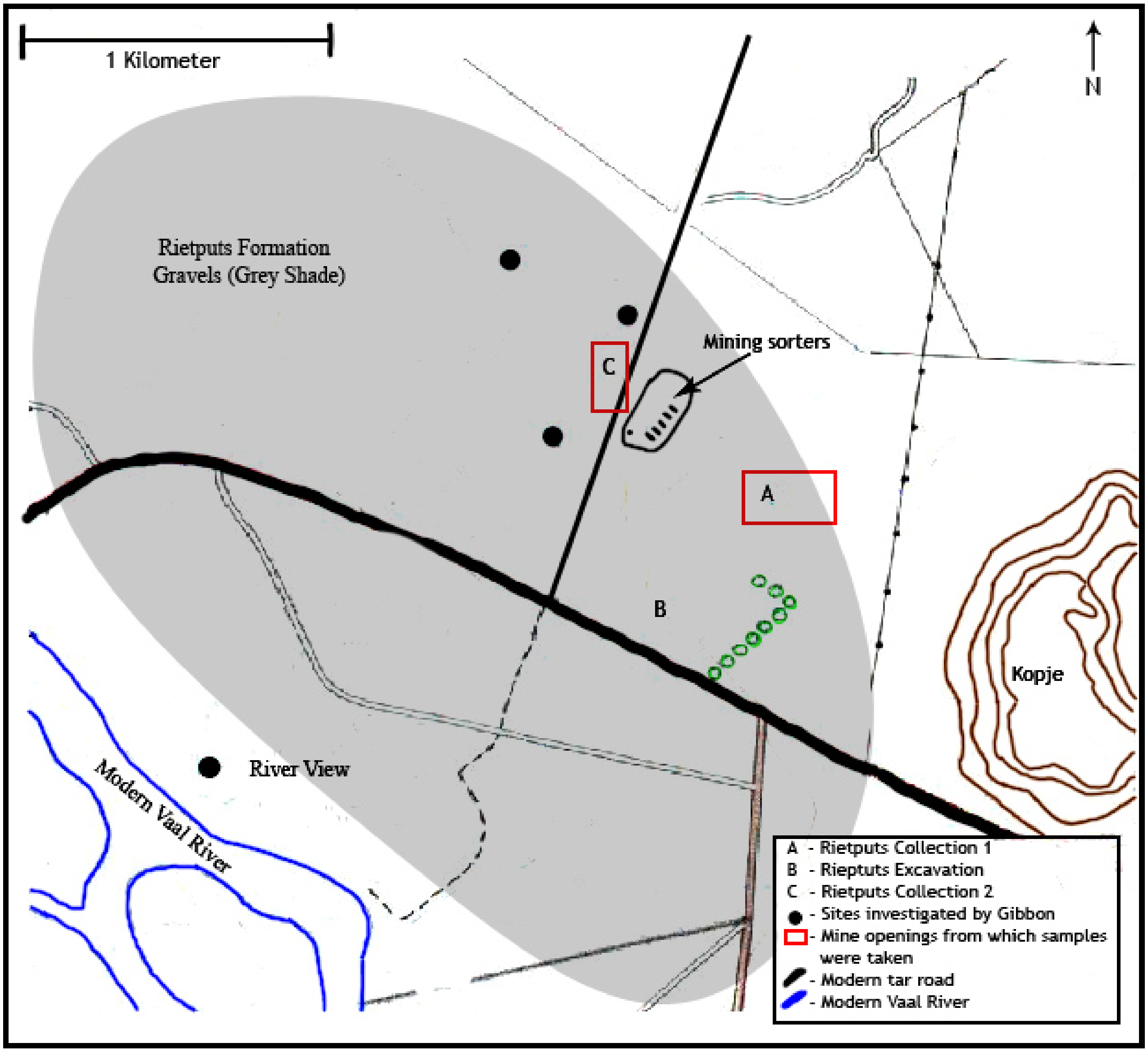

Figure 1.2 Sites at Windsorton, South Africa. Collection 1 comes from Pit A, the excavation was conducted at location B and Collection 2 comes from Pit C.

CHAPTER 2: LITERATURE REVIEW

2.1 EARLY ACHEULEAN

Typically the appearance of bifacial large cutting tools (LCTs) such as handaxes and cleavers marks the beginning of the Acheulean tool industry. The earliest date for the Acheulean is 1.7 Ma at Konso Gardula in Ethiopia (Asfaw *et al.*, 1992; Beyene *et al*., 2006). Similarly, West Turkana in Kenya yields early Acheulean at 1.65 Ma (Roche, 1995; Roche and Kibunjia, 1996).

Nearly as old as these sites are the famous Rift Valley sites in Tanzania. Olduvai Gorge middle and upper Bed II is dated to 1.6 to 1.4 Ma (Leakey, 1976; Hay, 1976). In Kenya, the Developed Oldowan sites at Koobi Fora, East Lake Turkana are around the same age (Isaac, 1997). Typologically comparable artefacts appear outside Africa as early as 1.4 Ma in Israel at Ubeidiya (Bar-Yosef and Goren-Inbar, 1993).

These early dates demonstrates the importance of the Rietputs site's early age (1.4 Ma). It shows that the earliest Acheulean hominids were present in central South Africa as early as in East Africa (Gibbon *et al*. 2009).

The handaxe has long been the focal point of most research within the Acheulean. From the emergence of simply made and unstandardised handaxes around 1.7 to 1.4 Ma, there is a progression through time to thin, well made handaxes in the later Acheulean after 0.6 Ma. Although it is difficult to show a link between handaxes and symbolism or language (Wynn 1995), they do express a great deal about the development of hominid knapping skills over time (McPherron 2000). The long span of time over which bifaces are made and the vast numbers of these diagnostic artefacts makes the Acheulean a key area of interest in hominid mental development.

A detailed study of the bifaces at Olduvai Gorge conducted by Roe (1994) emphasizes the real differences in biface morphology over a given amount of time. The earliest handaxes have a much wider variability in their morphology as compared to later dated handaxes (Roe 1994). Over time, larger percentages of handaxes are made on flakes rather than cobbles (Roe 1994). The more refined handaxes also tend to have a much higher scar count than their earlier counterparts (Roe 1994). The morphological refinement in LCTs has been a main defining factor in the separation of "Early", "Middle" and "Late" Acheulean criteria. Some researchers (Isaac 1968, Clark 1994) however, have rejected the grounds for a "Middle Acheulean" opting to rather use "Lower", "Late" and "Terminal" or "Post" (ie Sangoan). Although visibly LCTs become more symmetric and have higher scare counts using only typology to deem a 'Middle' Acheulean seems rather outdated as new dating technologies can be used instead.

LCTs such as handaxes have been a focal point in the study of the Early Acheulean for a long time. Interestingly, the core technology has received far less attention and is long overdue for greater analysis (Sharon 2007) though it is important to note that more recently Acheulean core technology has started to be studied though not necessarily *early* Acheulean (Sharon 2007).

In South Africa, the Early Acheulean has had a very limited distribution until 2006 (Gibbon *et al*., 2009; Kuman 2007; Kuman and Gibbon, in press). The three known sites of Sterkfontein, Swartkrans and Kromdraai are all in Gauteng's Cradle of Humankind. Member 5 of Sterkfontein is the largest and most prominent collection and dates to ca 1.7-1.4 Ma (Vrba 1982; Klein, 2000; Kuman 1994, 2007). At Swartkrans, a few bifaces are said to derive from Member 2, which is thought to be around 1.5 Ma based on fauna

(Brain *et al*. 1988; Brain, 1993). Finally, Kromdraai A has a small but comparable assemblage which appears to be of Early Acheulean age (Kuman *et al* 1997; Kuman 2007).

Some researchers suggest that even the presence of one handaxe or cleaver is justification for calling the assemblage Acheulean (Kuman 2007). Rietputs has over 100 bifaces, again stressing its technological importance for the study of early Acheulean in southern Africa as well as all of Africa.

2.2 HISTORY AND LITERATURE OF ARCHAEOLOGY OF THE VAAL

South Africa's Vaal River extends 1125 km from the mountains in Mpumalanga in the East to its conjunction with the Orange River just southwest of Kimberley in the Northern Cape. Over the last 20 million years, the river channel has migrated across the floodplain eventually finding its current path (de Wit *et al.* 2000). During this process it has laid down billions of tons of alluvial sands and gravels. It is widely accepted that early Plio-Pleistocene hominids inhabited areas of close proximity to water (Villa 1983), as it is an indispensable resource for life. In addition, the Vaal gravels provided abundant raw materials for the stone tools subsequently captured within these deposits.

Although many of the Acheulean sites are found in the interior of the country, they are not confined to the Vaal gravels. Though many of the collections have been analyzed the dates on the sites remains a problem. Comparison of many of the sites is done simply on typological grounds. Only now with new dating techniques can be being to obtain accurate dates on the deposits. Some of the better known sites are discussed here, attesting to a long sequence of industries to time.

Rooidam

The alluvial site Rooidam was excavated by to a depth of 9.8m (Beaumont 1990). Its rich Stratum 9, which sits 3.9m below the surface, yielded 90% of the 19,000 artefacts recovered from the site (Fock 1968, Butzer 1974, Beaumont 1990). The occurrence of small handaxes as well as a small amount of cleavers, blades and convergent points suggests this is a terminal Acheulean phase closely related to the 'Fauresmith' (Beaumont 1990). This site is typologically younger than Rietputs 15, but may offer insight as to the next phases in Acheulean core organization.

Kathu Pan

Situated 195km northwest of Rietputs 15, Kathu Pan excavations have produced some technologically refined handaxes (Beaumont 2004a, Kuman 2007). Its association with elephant fossils is comparable to Olduvai Bet IV and therefore places it in the later Acheulean (Volman 1984, Klein 1988, Beaumont 2004, Kuman 2007). Strata 4a and 4b faunal remains have a dominance of grazers, indicative of a dry grassland at the time. Thus Kathu Pan's permanent water may have been a draw for later Acheulean hominids (Beaumont 2004a).

Wonderwerk Cave

150km northwest of Kimberley is Wonderwerk Cave. An ancient solution cavity, Wonderwerk is exposed on its north end by hillside erosion (Beaumont 2004b). Excavations have yielded at least 10 major units that include the Later Stone Age (LSA) at the top, Middle Stone Age, and later Acheulean (Beaumont and Vogel 2006; Beaumont 2004b). Recent radiometric dates place the earliest Acheulean deposits in the cave at ~1.6 Ma, which are claimed by the authors to be the earliest hominid exploitation of caves anywhere in the world (Chazan *et al.* 2008). However, a detailed description of the assemblage is not yet available.

Canteen Kopje

The National Heritage Site approximately 35 km from Windsorton has alluvial gravels which have been of interest to archaeologists since the early 1900's (van Riet Lowe 1945).

During the 1920's and 1930's regular trips were taken by the Professors at the University of the Witwatersrand and other universities to visit Canteen Kopje, as well as other Vaal gravel sites, to collect stone implements. In July 1929 Professor C. van Riet Lowe led a group of amateur prehistorians as well at the famed Abbé Henri Breuil and A.J.H. Goodwin on a trip to the Vaal gravels (Goodwin, 1933; Breuil, 1948; van Riet Lowe, 1948). By having these three famed prehistorians as the primary investigators, this may have well been the most important collection of Acheulean artefacts along the Vaal for the next 40 years.

Large numbers of bifaces, cores and flakes of all sizes litter the surface, which have been collected for years by archaeologists (Sharon and Beaumont 2007). The first systematic excavations here in 1997 uncovered thousands of artefacts that include Victoria West prepared core technology, which is a conceptually standardised technique (Beaumont and McNabb 2000; McNabb, 2004, 2008). The first systematic excavations at Canteen Kopje revealed LSA and Fauresmith in Stratum 1 within the Hutton Sands (Beaumont and McNabb 2000). Lower Strata 2a and 2b contained Acheulean artefacts, including the famous Victoria West prepared core technology in 2a (Beaumont and McNabb 2000).

Pniel 1 and Pniel 6

Many of the original collections from the Pniel 1 site must today be considered stratigraphically suspect. New collections from 1984-85 have a solid provenience and provide better information to a still small assemblage (Beaumont 1990).

Collected samples from Pniel 6, presumed to be from Stratum 4 have displayed two poles in the quality of handaxe manufacture. Smaller ‘almond shaped’ handaxes in a locality associated with a higher inference of hornfels as well as an area of larger andesite handaxes with less variability of raw material (Beaumont 1990).

Based on a typological comparison to Pniel 1, Pniel 6 is considered similar. In addition the faunal dates at Pniel 1 which suggest an age of 0.8 Mya may be comparable at Pniel 6 (McNabb 2004). Again, this places the site later than the Rietputs collection, but core technology may be comparable in order to understand a continuum of technological development in the region.

Doornlaagte 1

The diamond diggings at Doornlaagte 1, about 42 km west of Kimberley, revealed what has been thought to be a near-primary context deposit (Beaumont 1990). The Acheulean ‘living floor’ (stratum 3) yielded 2,000 artefacts and of the bifaces, handaxes and cleavers dominate but also include prepared cores (Mason 1967, Beaumont 1990). Based on markedly end struck flakes the site is considered to be later in age than Pniel 1 or Pniel 6 (Beaumont 1990). However, with a large amount of artefacts on andesite and cleavers amongst prepared cores, a modern investigation is desperately needed.

2.3 SIGNIFICANCE OF ORGANISED FLAKING FOR THE ACHEULEAN

New research is suggesting that some advanced hominid knapping abilities are apparent as far back in time as the Oldowan (eg., de la Torré et al. 2004; Delagnes and Roche 2005; Semaw 2000). The site of Gona, Ethiopia, which dates to 2.5-2.6, Ma has surprisingly well flaked cores which demonstrate advanced eye-hand coordination (Semaw 2000). Delagnes and Roche (2005) argue that hominids at Lokalalei 2C in Kenya had an extensive understanding of fracture control during the knapping process as far back at 2.34 Ma. At Lokalalei 2C at this time, there is evidence that hominids were able to select the cobbles with the appropriate shapes and had the ability to maintain core convexities for extended flaking sequences, although they did not necessarily have the ability to create or correct these angles (Delagnes and Roche 2005). The Oldowan site of Peninj, which is dated to 1.6-1.4 Ma, de la Torre *et al.* (2003), shows that hominids had begun experimenting with organized flaking of cores for pre-determined flake products.

Although these early examples of core organization are not equivalent to prepared core strategies, they do indicate its roots. As far back as 1945, van Riet Lowe suggested the Levallois was a "developing… technical process through a period of much greater length than is covered by the development of its European counterpart" (1945). Although the criteria for the definition of prepared core technology are continually debated as new research is conducted, sites in Africa are demonstrating a higher degree of flaking skills than previously thought. It is widely accepted that the roots of prepared core technology are firmly in the Acheulean.

Prepared core technology is a highly debated aspect of hominid evolution. There are various definitions spelling out sets of attributes that characterize a prepared (Van Peer

1992; Dibble and Bar-Yosef 1995). As a general definition, prepared core technology refers to "a number of technologies...in which the core was intentionally shaped or prepared in such a way as to predetermine the shapes of flakes taken from it" (Debénath and Dibble 1994). In addition the symmetry of the core plays a large role in some definintions (Boëda 1995).

Currently the oldest truly 'prepared' core technology comes from Israel and dates to ~0.79 Ma (Goren-Inbar and Saragusti 1996); however, no detailed description has yet been published. In South Africa, "Victoria West" prepared cores, first described by Jansen (1926), were found at Canteen Kopje near Rietputs 15 during the first systematic excavations there (Beaumont and McNabb 2000, McNabb 2008), but these gravels are believed to be much younger than Rietputs 15 and contain Fauresmith at the very top. In middle/later Acheulean sites such as Canteen Kopje, prepared core technology becomes fairly common. However its origin may be much older (Kuman 2007), as Rietputs 15 material may help to potentially indicate. The organised flaking strategies may, as Rietputs 15 suggests, lead to the development of organised cores in the middle/later Acheulean. Just as Clark (1982) suggests that the Victoria West is a form of Proto-Levallois technology, Rietputs technology may be seen as a forerunner to the Victoria West principles of core preparation.

The roots of prepared core technology can also be found in the East African Acheulean. In the Kapthurin Formation in Kenya, Tryon *et al* (2006) suggest that large Levallois flakes that were struck from boulder cores and were retouched into cleavers. Their analysis also suggests that there is a "technological continuum that spans the Acheulian-MSA transition" (Tryon *et al*. 2006).

At Rietputs, I believe we see a point in the continuum leading towards prepared core technology. As with Peninj at 1.5 Ma and even at Lokalalei 2C at 2.34 Ma, I believe hominids at Rietputs had a relatively sophisticated understanding of raw material procurement and management. This can come in the form of asymmetrical core organization, large or elongated single platform removals and preferential flake removals.

As at Peninj, Rietputs 15 contains a number of cores with *some* of the characteristics we see in core preparation. However, only one core in the current sample fills all the criteria used to identify prepared cores, and thus the advanced nature of this example is probably fortuitous, and the method is not used systematically. The main characteristic of the Rietputs 15 organized cores is the asymmetrical shape which allows for removal of one or more flakes in a hierarchical manner. While they are not fully prepared, however, they have more in common with prepared core technology than with casual core technology. Assumedly, the Vaal provided hominids with large, angular river cobbles with large surfaces from which to produce tools. Such large cobbles can be flaked intensively and produce a wider variety of final core morphologies (Toth 1985). This being said, it is my belief that the significant number of organized cores at the Rietputs 15 site does not happen by mere chance, but instead it is a step in a continuum of hominid mental development shown in this technology. Rietputs 15 organized cores will offer another piece to the prepared core origins puzzle, particularly when compared with the Victoria West and Fauresmith industries which succeeded Rietputs technology in time.

Study of the technology of any ESA stone tool, be it prepared cores, cleavers or handaxes, is an attempt to address issues of hominid cognitive development (McPherron 2000). There is still much more work to be done on cognitive development through more in depth studies of the stone tool technology and its progression. I suggest that the traditional emphasis, which has been primarily on bifaces, needs to shift towards study of the cores and the organisation of knapping strategies.

CHAPTER 3: Rietputs 15

3.1 THE SITE OF RIETPUTS 15 AND SAMPLE COLLECTION

The site of Rietputs 15 (S28° 19’ 37.26”, E24° 44’ 47.57”), Windsorton, South Africa, is approximately 1.5km from the modern Vaal River. The ancient river gravels, which were laid there by the meandering Vaal River over hundreds of thousands of years, occur from 6 to 15m below the current surface. It is these same gravels that contain the diamonds that have made South Africa famous. Many mining companies have claims in the region and regularly dig massive pits to expose these gravels, and with their cooperation, we are allowed to enter these pits and study both the stratigraphy and the stone tools (Figure 3.1).

At the south end of Rietputs 15 lies a large koppie which was surveyed (by G.M. Leader) in May 2007 and has several Later Stone Age scatters as well as historical “kraal” type features at its base (Figures 1.2 & 3.2) These artefacts are more than 500 meters from the diggings and are therefore unaffected by the mining. In addition, the scatters become less frequent moving away from the base of the koppie before completely ending about 300m from the diggings. These Later Stone Age artefacts are the only lithics in the area, and they are very different to the Acheulean material in size (small flakes), material (mostly cherts), and abrasion (much fresher). This observation and the rarity of artefacts in the fine alluvium overlying the gravels support the claim that there are no artefacts from the surface or from younger deposits that may have worked into the collection.

Figure 3.1 An example of the diamond pits at Rietputs 15. The hornfels bedrock is exposed at the bottom and is overlain by gravels. The gravels are overlain by fine alluvium.

Figure 3.2 "Kraal" feature at base of Rietputs 15 koppie

In Pit A, there are 7-9 distinct stratigraphic layers present, depending on which section of the pit is analysed (Figure 3.3). Palaeosols in one area at higher levels thin out and become discontinuous (Gibbon *et al.* in press). At the north end of Pit A, nine distinct layers were present (Table 3.1)

Table 3.1 Strata recorded in depths from surface. Taken from the north wall of Pit A. Depths are recorded at the bottom of each layer.

Stratigraphic Layer	Lowest Depth
Dark Red Modern Soils	2.4m
Red Soils	2.7m
Brown Slightly Calcretised	3.35m
Dark Brown	3.8m
Light Brown	4.7m
Tan Heavily Calcretised Soils (Palaeosols)	7.7m
Tan Heavily Calcretised Soils (Palaeosols)	12.2m
Tan Heavily Calcretised Fine Alluvium	15.0m
Alluvial Gravel Layer, Acheulean tool-bearing	18.3m
Bedrock	--

The gravel layer begins at 18.3m and topped by an upper fine alluvium, a flood plain at one time (Gibbon, pers. comm.), which is almost sterile of artefacts in these exposures. Above this level lie extremely hard calcretized palaeosols which are devoid of artefacts.

Examination and collection of the Rietputs pits were carried out immediately upon exposure, as the mining was not halted for exploration. It was imperative to interpret the strata and collect the assemblage in one trip before the pit was backfilled and a new pit opened elsewhere.

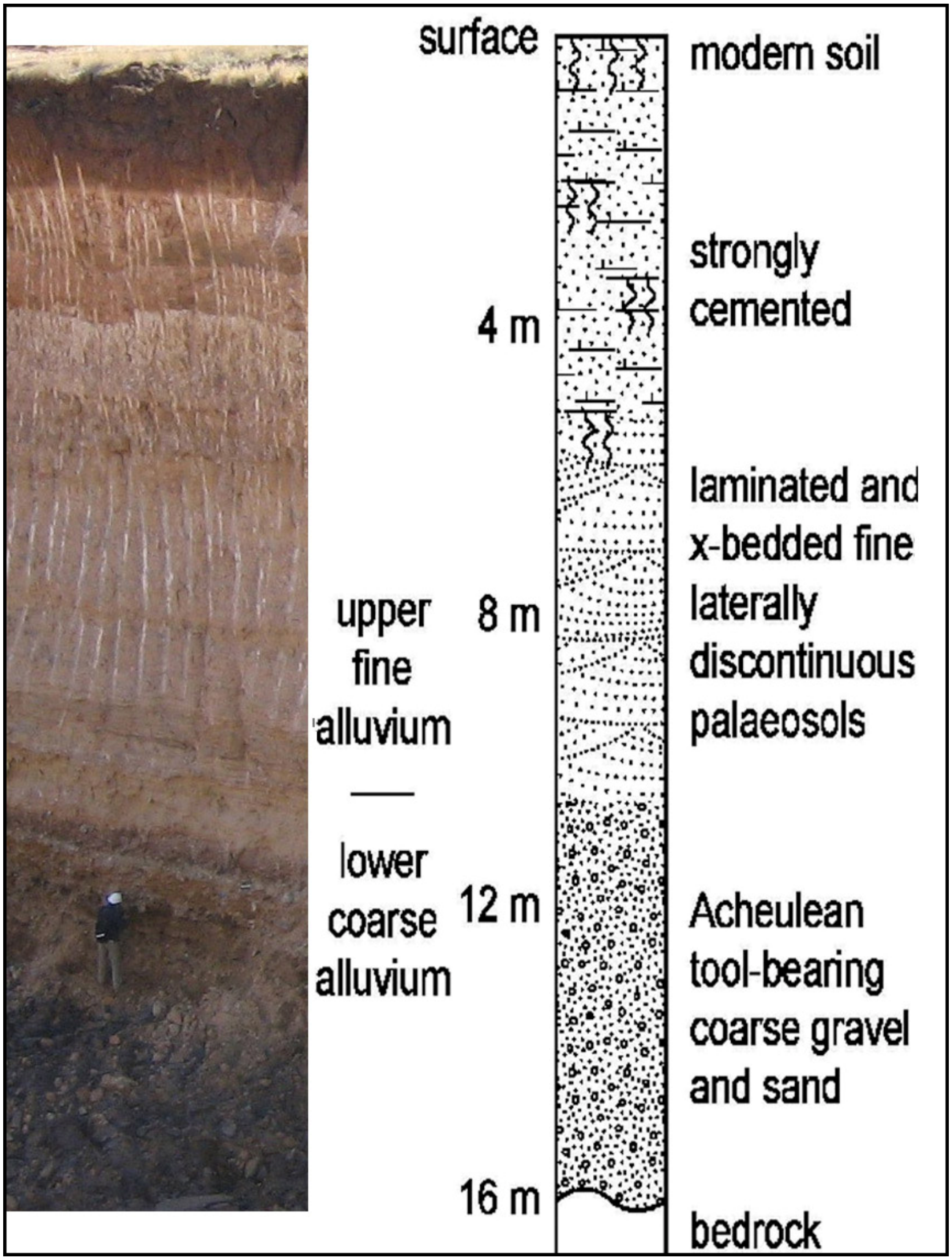

Figure 3.3 Stratigraphy of Pit A at Rietputs 15. (Courtesy of R.J Gibbon)

3.2 MINING PROCEDURES AND SAMPLING OF ARTEFACTS

To fully control the provenience of the collection an understanding of the exact procedures of the mining operations was necessary. The pits, which range in size but average about 100 metres by 50 metres, are dug with large back-hoes. The tool-bearing gravel layer that sits 15.05 metres below the surface is the location of the artefact sample. For safety reasons the back-hoes dig to 5 metres depth per sweep over the entire pit before moving down to the next 5 metres. This technique also helps to eliminate any mixing from higher or surface layers. Once the gravel layer is reached, the sediment is then loaded into a dump truck.

This load is then taken to an initial sorting machine which tumbles the gravels to remove the large boulders. This results in a collection that is void of all artefacts larger than 300mm. The sediment is then re-collected and taken to a second sorting machine (Figure 3.4). Here all material less than 30 mm is removed to sort out all diamond-sized material). Access to this material is not allowed, hence the collection has no artefacts less than 30 mm. There are anywhere from five to eight of these machines running 24 hours a day. After the final processing of the material is completed, it exits the machine by way of a conveyer belt. The conveyer belts of the eight sorters then dump the material onto one final conveyer belt, which moves it to a final location where it will be loaded into a truck for backfilling into the pit at a later date. The artefact collection was taken off of the final conveyer belt, ensuring that the maximum amount of archaeological material (in the 30mm to 300mm size range) passes the collector, producing an incomplete but nevertheless highly representative sample of artefacts in the gravels.

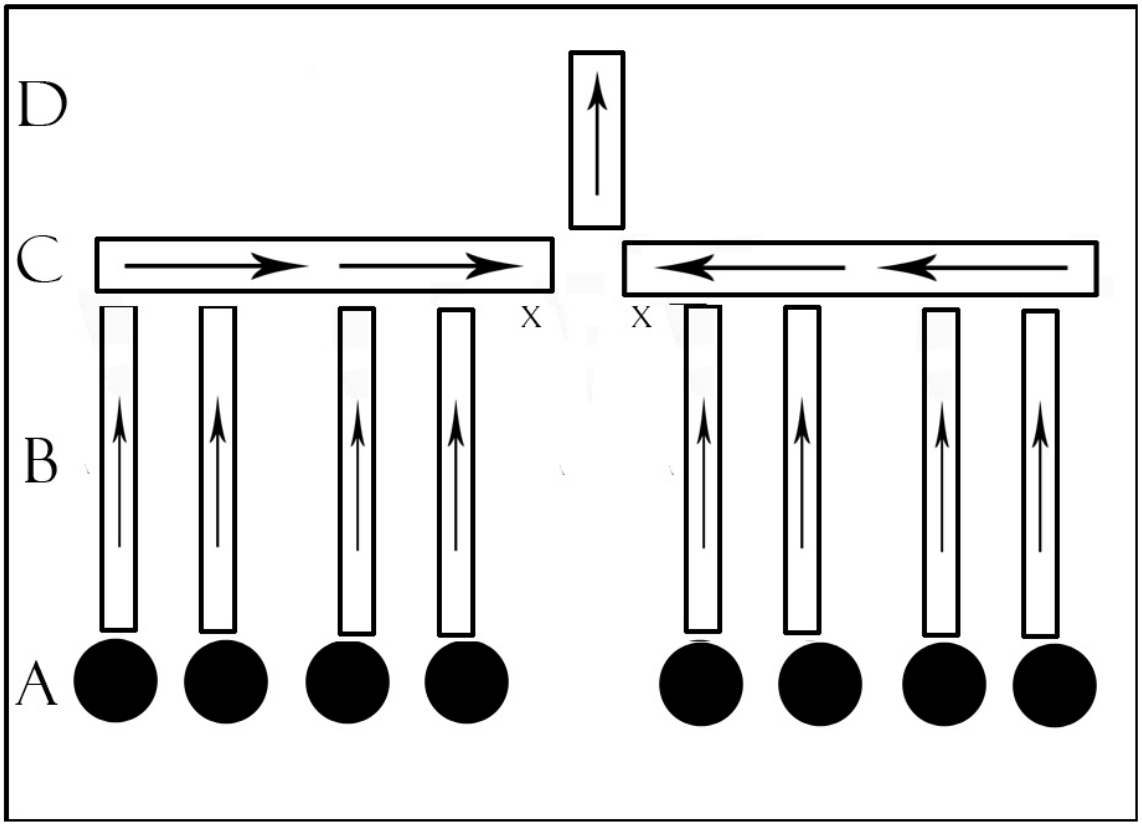

Figure 3.4. Mining conveyer belt diagram. Material first passes through the large boulder sorter and then is sorted here. A: material passes through a sorting machine which removes all material <30mm. B: material proceeds down first conveyer belt. C: all conveyer belts place material on final conveyer belt. D: material exits to a final dump for backfilling into the pit. 'X' represents the points of collection.

3.3 COLLECTION PROCEDURES

In September 2006 a trip to Windsorton was organized with the goal of obtaining a large, provenience-controlled sample of artefacts from Rietputs 15. With the assistance of J. Du Piesanie, 1174 artefacts (Collection 1) were retrieved from the mining conveyer belts (Figure 3.5 and 3.6). The collection took place over 5 days with an average of 7 hours per day spent collecting. Due to the massive amount of material on the belts, some artefacts were certainly missed; however every effort was taken to retrieve all artefacts.

This procedure allowed us to obtain a large provenience-controlled sample from one particular stratigraphic layer of Pit A.

This method creates a sample collection that is complete as humanly possible. However it is not a “selected” collection. Each time an artefact was seen it was collected; there was no bias towards particular typologies. It is acknowledged that there may be a bias towards larger artefacts, as these are more easily seen.

Figure 3.5 Mr. J. Du Piesanie collecting artefacts from the conveyer belt.

Figure 3.6 Conveyer belts at Rietputs 15.

3.4 EXCAVATION PROCEDURES

In November 2006, a traditional archaeological excavation of the gravels was organized. The purpose of hand digging through a massive amount of deposit (6.4 m in depth) was to document that the stratigraphic layers above the Acheulean tool-bearing layer are sterile of artefacts. In addition it was important to have a properly excavated sample of all size categories for comparison to Collection 1. This allowed us to confirm no mixing was happening and to check for artefacts that might be smaller than 30 mm, which was the lower limit of the diamond sorting process.

First a location had to be found (Figure 1.2). Due to time and budget constraints it would have been nearly impossible to dig more than 10m depth through the calcrete. Fortunately a location only ca 0.5km from the Collection 1 pit was found (Site B: Rietputs Excavation, Fig. 1.2; S28° 19' 51.0", E24° 44' 33.9"). Here the mining company left open a pit with the *in-situ* gravels, overlain by about 6.4m of calcretized sediment (Figure 3.7).

Figure 3.7 Location of Rietputs Excavation. Note: *In situ* gravels begin at elbow of the man in the picture.

Figure 3.8 Excavation at the top of the Rietputs gravel layer.

A 1 cm sieve was used in the excavation, and therefore artefacts smaller than 10 mm in size would have been missed (Figure 3.8). However, alluvial gravels are less likely to preserve artefacts less than 1 cm in size. The excavation took place over a 10 day period, and the gravel layer was dug in spits of 10 cm levels. Three squares, 1m by 1m, were excavated (Figure 3.9).

With the exception of three flake fragments found at 3.4m above bedrock (2 m above the top of the gravel layer), all deposits from surface to the top of the gravels yielded no artefacts. These three artefacts were found in the Tan Heavily Calcretised Fine Alluvium (Figure 3.10).

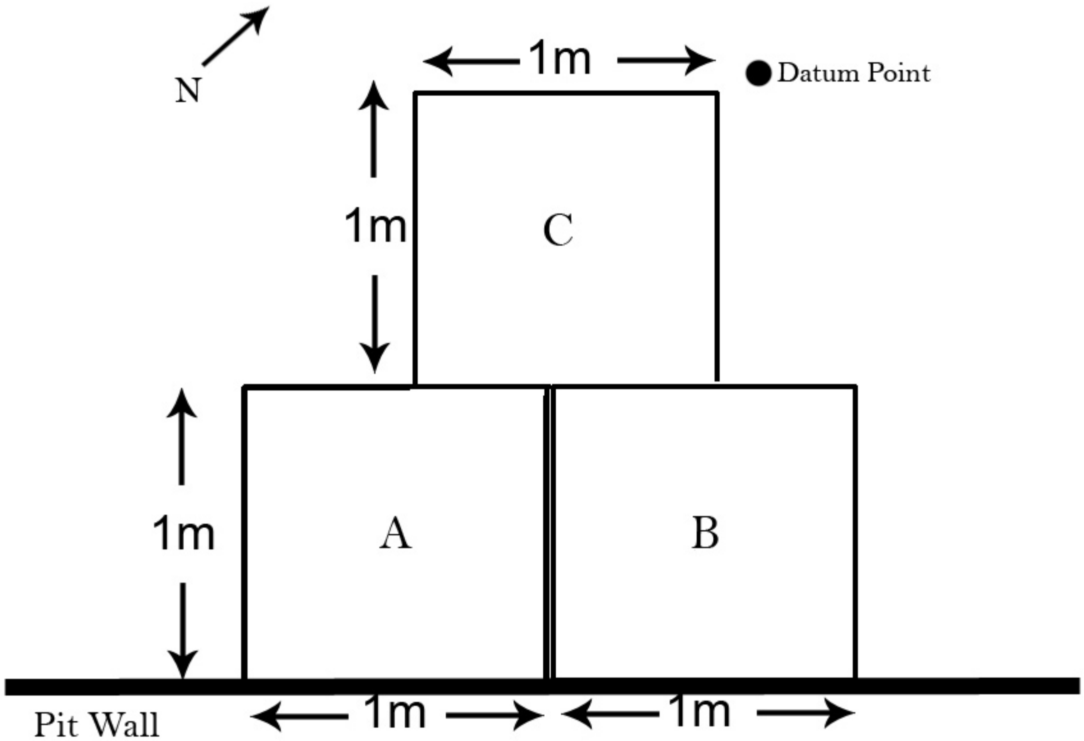

Figure 3.9 Plan view of the Rietputs 15 Excavation.

Once the gravel layer was reached, 123 artefacts, mostly flakes and flake fragments, were recovered. This sample is representative of the small material that is missing from the selected sample (Collection 1) from Pit A. It includes material <30mm that is excluded from Collection 1. The excavation therefore demonstrated that this smaller component of material is present in the gravels. Although the material does contain the smaller component of Rietputs material, it is not confined to artefacts <30mm (Discussed in Chapter 5).

Due to time constraints, only 2 of the 3 squares were taken all the way to bedrock. Square C reached the very top of the gravel layer but was taken no further. Only one artefact was found at the very top of the gravels in square C, so 122 of the artefacts come from just 2 squares.

Sediment samples were taken from the wall of the excavation for possible cosmogenic dating methods to be applied. Since no dates have yet been run on these samples, it is not demonstrated that the site is equal to the same time period as Collection 1 from Pit A. However, this location is certainly within the 1.7-1.3 Ma range (Gibbon pers. comm.).

Figure 3.10 Digging by hand through the calcrete. Just overlying the gravels at the Rietputs excavation.

CHAPTER 4: METHODOLOGY

4.1 Methodology

To understand Rietputs 15 a data set was first created based on the entire artefact assemblage. The first step in the process is classification by typology. Typological classification was based on both the classic types as described by M.D. Leakey (1971) and on Kuman's (2001) technological types. Types were further studied through a series of standard measurements taken from each individual artefact. This data includes maximum length and width. While the project focused on a generalized technological study and the core flaking strategies, a basic analysis of the handaxes is also provided. A more detailed study of the handaxe technology is, however, intended in the future.

Raw materials have also been addressed in this study. It is important to understand the average size and shape of the blanks that the hominids appear to have been selecting for cores.

4.2 Artefact Classification and Technological Analysis

The tools collected from Rietputs 15 were classified by the morphology of the end product into the following artefact types:

4.2.1 FORMAL TOOLS CLASSIFICATION

HANDAXE: A bifacial (and occasionally unifacial) heavy-duty tool made on a cobble or large flake that is specifically knapped to produce a sharp cutting edge or edges which converge to form a point, creating a usually symmetrical artefact. Only those tools with sides converging in a pointed end are included in the handaxe category. The emphasis is on the overall shaping of the piece.

PICK: A tool in which the focus is on a single "point" on the end. It can be bifacial or unifacial and it also can be largely cortical, with minimal working apart from the tip. Many picks therefore show less overall shaping and symmetry than handaxes.

CLEAVER: A biface or uniface that has a shaped "bit" which is usually perpendicular/sub-perpendicular to the long axis of the tool. The bit was presumably intended for chopping or heavy-duty cutting. Many cleavers are made on large flakes.

SCRAPER: A flake tool which shows consistent small unifacial removals on one or more edges, presumably for scraping.

NOTCHED SCRAPER: This is a scraper in which the removals are large 'notches' on one or more edges**,** presumably for a wood-working, scraping function.

HEAVY DUTY SCRAPER / CORE SCRAPER: Similar to a single platform core, this type of scraper has a single relatively steep edge with unifacial removals. Although the removals may be relatively large, the edge morphology suggests they are intended for shaping of the edge for tool use, rather than for core-flaking.

KNIFE: A bifacially worked flake with a single long working edge, often made on a long flake-blade.

FLAKED FLAKE: A flake with one to a few large removals on one or more of the edges. The piece may have been intended as a type of core or used as a notched scraper.

4.2.2 FLAKES AND FLAKING DEBRIS CLASSIFICATION

The majority of most collections is made up by flakes, which may be the waste products of knapping, tools in their own right, or blanks for other tools. Even though Rietputs is an alluvial gravel site, there are 656 flakes and flaking debris in Collection 1 (55.9%), which have been grouped into these categories which include technological information.

COMPLETE FLAKE: A flake in which all the landmark characteristics are visible: the striking platform, bulb of percussion, and distal and lateral terminations. These flakes are further classified into the following technological flake types.

END STRUCK FLAKE: A complete flake with the striking platform perpendicular to the long axis of the artefact.

SIDE STRUCK FLAKE: A complete flake with the striking platform in line with the long axis of the artefact.

CORNER STRUCK FLAKE: A complete flake with the striking platform neither on the short or long axis of the piece. Rather, the platform is somewhere in between (or at the 'corner') of the artefact.

KOMBEWA FLAKE: A complete flake with two ventral faces. These indicate that large flakes (produced from rock outcrops, boulders or large cobbles) have subsequently been used as cores, resulting in a ventral face equivalent to the dorsal.

CORE TRIMMING FLAKE: A complete flake removed with the intention of adjusting a core's striking platform or removing an angular edge. They are often triangular in cross-section.

INCOMPLETE FLAKE: A flake with a clear ventral and dorsal face, certainly cultural, however with no striking platform or bulb present.

SPLIT FLAKE: A flake which has been broken directly down the center of the bulb of percussion all the way to the termination of the flake. These occur during the knapping process.

FLAKE FRAGMENT: A portion of a flake that is usually recognized by its clear ventral and dorsal faces but which lacks the bulb and platform. It may be the result of knapping breaks or of either modern or ancient damage.

CHUNK: A piece of knapping shatter (debitage) that does not have the properties of a flake but is not caused by nature.

4.2.3 INFORMAL ARTEFACTS CLASSIFICATION

These are artefacts that do not fit into the formal tool types but are judged to be more tool-like than core-like. They may represent unfinished tools.

ROUGHOUT: A bifacially worked artefact that is only roughly formed and probably was discarded before finishing. The intention appears to have been a handaxe, pick or cleaver but the piece lacks the formality to place it in one of these groups.

PROTO-BIFACE: A bifacially worked tool that approaches the shape of a handaxe but is less formally worked. Some may resemble pointed choppers.

4.2.4 CORE CLASSIFICATION

There are 322 cores in Collection 1 that have been classified into the following types:

BOULDER CORE: An informal core larger than 256 mm with removals that would most likely have been used as blanks for tools.

CASUAL CORE: A core from which only one or two flakes are removed.

CHOPPER CORE: A bifacial and occasionally unifacial core which has removals along one edge, either for flake production or for creation of a "cutting" or "chopping" edge. In the Rietputs collection, damage and abrasion caused by movement in the gravels make it impossible to distinguish use-wear and therefore many artefacts that many have been used as "choppers" are classified in this group.

DISCOIDAL CORE: A core that is worked radially. The end product resembles a thick "flying saucer" or disc shape. It may be bifacial or unifacial.

RADIAL/SUB RADIAL CORE: A core that is worked in radial fashion, with a varying number of removals, but which is flatter than a discoid. It can be either bifacial or unifacial.

IRREGULAR CORE: A core of irregular shape with removals in a random, unorganised fashion from varied directions.

POLYHEDRAL CORE: A core of spherical shape that is consistently worked from varied directions.

SINGLE PLATFORM CORE: A core with removals from a single platform core, all in the same direction. This type is distinguished from chopper cores in having a generally more right-angled working edge. The type is sometimes also confused with 'heavy duty scrapers', which are diagnosed as tools by use-wear (which cannot usually be assessed in a gravel collection).

CORE FRAGMENT: An artefact that has large removals diagnostic of a core but which is broken, either in ancient or modern times, and therefore cannot be classified by core type.

CORES WITH ORGANISED FLAKING STRATEGIES. These core types are discussed in detail in Chapter 6.

4.3 ATTRIBUTES

The collection was analyzed for a number of technological and other attributes on each individual artefact. Many of these attributes relate to the type of raw material used, its flaking properties, and the shape and size of the cobbles. The raw materials used in Collection 1 are: chalcedony, chert, dolerite, felsite, hornfels/baked shale, Ventersdorp lava, jaspalite, quartz and quartzite. The dominant raw materials in the collection are hornfels/baked shale (64.14%) and Ventersdorp lava (24.41%).

Condition:

There are no very fresh artefacts in the collection and so the abrasion state was also determined. This is a relatively subjective attribute that varies according to the raw materials in a collection. A single artefact could also have two types of condition if it becomes caught in place and one part of the piece is more shielded from abrasion than another. To avoid inconsistency, only one person, the writer, determined the state of abrasion. These were classified as:

Slightly Abraded: In this category, an artefact has noticeably sharper edges than in the other two categories, and dorsal scars or retouch are clearly distinguishable.

Abraded: The edges of an artefact are fairly worn and not sharp to the touch. Any scars on the artefact are noticeable but not sharply defined.

*Very Abraded***:** The edges of an artefact are very worn and almost rounded. Any scars are very worn down and eroded, with margins that are not well defined. The bulb of flakes may be very eroded (flattened) or almost gone.

At Rietputs the state of abrasion does not inform about "weathering" like at many other sites in which the artefacts are exposed to surface elements for long periods without abrasion. Rather, at Rietputs, the abrasion state may indicate the amount of rolling within the river the artefact underwent before being buried in the gravel layer. It is important to note that an artefact which is abraded more than another does not necessarily indicate that it was “rolled” a long distance in the river (Volman 1984), as artefact weight, hardness, water turbulence and length of surface exposure are all contributing factors. Therefore, the abrasion of each artefact does not indicate its age or traveling distance in this particular gravel context.

Length:

Maximum length was recorded for all pieces, but before this could be taken, an assessment of any damage was done. Due to the mining procedures with heavy backhoes and sorting machines many of the artefacts have mining damage. In some instances the mining damage may influence the maximum length while in others it may only affect maximum width or just a small portion of the surface. Maximum lengths were not taken if pieces were too damaged to assess. In addition, bifaces were also measured for length and width along the axis of symmetry (see Chapter 5 for discussion).

Cortex:

Cortex can be indicative of procedure and reduction during the knapping process when found in a primary context site. However, the alluvial site of Rietputs lacks this data. Instead, at Rietputs, cortex is used to understand the original morphology of the blank. Cortex was recorded on each artefact as present or absent.

Calcrete:

Some of the artefacts in the Rietputs collection have coatings of calcrete. In alluvial contexts in arid and semi-arid regions, calcrete can form over a relatively short period of time and even in sporadic localities within individual layers. Therefore the presence or absence of calcrete does not provide any particular age or depositional information. However, calcrete was recorded as present or absent on each artefact, as this information could potentially prove useful to geomorphologists studying the larger landscape.

4.4 Clast Analysis

To understand the knapping strategies at Rietputs 15, observations were made on raw material clasts in the area. There are massive amounts of gravels widely available in the area, but the vast majority consists of Ventersdorp lava and hornfels (Leader pers. obs.; Figure 4.1). Other raw materials in cobble form are present in these gravels (e.g. quartzite, chert and dolerite); however, these are certainly outnumbered by the availability of Ventersdorp lava and hornfels.

The Ventersdorp lava clasts tend to be very large (> 250 mm), which means that much of this material is in the large cobble to boulder size category (cobbles are defined as 64 to 256 mm, and boulders from 256 mm on the Wentworth scale). These clasts have many angled surfaces suitable for knapping off large flakes.

For hornfels clasts, there is somewhat more variety of forms available. In contrast to Ventersdorp lava which is primarily found in the larger angular clasts, hornfels can be found as both rounded river cobbles *as well as* tabular or "blocky" slabs. Hornfels may have been more desirable in the tabular form as it provides easily exploitable large surfaces. It has been suggested that the shapes and natural convexities of raw materials play an important role in flaking strategies right from the procurement stage (Brantingham and Kuhn 2001; Delagnes and Roche 2005). Although the two dominant raw materials at Rietputs differ in terms of size and shape, both have large surfaces and more angular shapes or edges that were intelligently exploited by the hominids' flaking strategies.

Figure 4.1 Author standing with some examples of large clasts at Rietputs 15.

CHAPTER 5: RESULTS OF TECHNOLOGICAL ANALYSIS

The following sections provide a detail description of the technological analyses completed on collection 1 of the Rietputs 15 site (Pit A). For ease of reference, all figures are grouped together at the end of the chapter.

5.1 General

Table 5.1 provides the classification percentages for the entire collection in proportional order. Although this is a gravel site, nearly 60% of the entire collection consists of flakes and flaking debris, and only 28% consists of cores. Figure 5.1 displays the size profile for the entire collection. For a coarse alluvial site, these data indicated a relatively good representation of the original materal.

Table 5.1 Typological classification

Artefact	Total Number	Total Percentage
Complete Flakes	**590**	**50.3%**
End Struck	210	17.9%
Corner Struck	169	14.4%
Side Struck	101	8.6%
Core Trimming	85	7.2%
Indeterminate Strike	24	2.0%
Kombewa	1	.09%
Core Types	**264**	**22.5%**
Chopper Core	81	6.9%
Irregular	53	4.5%
Radial/Subradial	44	3.7%
Discoidal	34	2.9%
Polyhedral	34	2.9%
Single Platform	7	.6%
Core Fragment	7	.6%
Casual	3	.26%
Boulder	1	.09%
Formal Tools	**179**	**15.2%**
Handaxe	79	6.7%
Pick	37	3.1%
Cleaver	29	2.4%
Flaked Flaked	12	1.0%
Heavy Duty Scraper	11	.9%
Scraper	7	.6%
Notched Scraper	3	.26%
Knife	1	.09%
Flaking Debris	**66**	**5.6%**
Chunk	25	2.1%
Incomplete Flake	22	1.8%
Flake Fragment	18	1.5%
Split Flake	1	.09%
Organised Cores	**64**	**5.5%**
Asym. w/ Pref. Removal	25	2.1%
Elong. Asym. Exploitation	16	1.4%
Asym. w/ Pref Surface	10	.9%
Largest Surf. Exploitation	9	.7%
Asym Discoid	4	.3%
Informal Tools	**11**	**.9%**
Proto-biface	8	.7%
Roughout	3	.3%

5.2 Damage

Table 5.2 shows the proportions of damaged material caused by mining procedures. As the artefacts are tumbled through the processing equipment it is inevitable that pieces will receive slight to moderate damage. This was only recorded as present or absent but no measurements were taken if damage interfered with the accuracy of the data. Although the great majority of the collection has some type of damage, much of this was very small.

Table 5.2 Collection 1 mining damage

Damage State	Number of Artefacts	Percentage of Collection
No Damage	349	29.7%
Damaged	825	70.1%

Table 5.3 shows the nine different raw materials. The vast majority is hornfels with the next highest being Ventersdorp lava. Figure 5.2 shows the number of artefacts in each raw material from Collection 1. Table 5.4 shows the abrasion states on the nine different raw materials for the entire collection. The majority of the collection falls into the ‘abraded’ state.

Table 5.3 Raw materials of Collection 1

Raw Material	**Total Number of Artefacts**	**Percentage of Collection**
Calcedony	7	0.60%
Chert	57	4.86%
Dolerite	17	1.45%
Felsite	2	0.17%
Hornfels/Baked Shale	753	64.4%
Ventersdorp Lava	310	26.41%
Jaspalite	1	0.09%
Quartz	1	0.09%
Quartzite	26	2.21%
Total:	**1174**	**100%**

Table 5.4 Proportions of the nine raw materials and abrasion states for Collection 1.

Raw Material	**Slightly Abraded**	**Abraded**	**Very Abraded**	**Total**
Calcedony	1	4	2	7 (0.6%)
Chert	24	22	11	57 (4.9%)
Dolerite	5	5	7	17 (1.4%)
Felsite	0	2	0	2 (.17%)
Hornfels/Baked Shale	154 (20.45%)	376 (49.93%)	223 (29.61%)	753 (64.1%)
Ventersdorp Lava	49 (15.81%)	128 (41.29%)	133 (42.90%)	310 (26.4%)
Jaspalite	0	1	0	1 (0.9%)
Quartz	0	1	0	1 (0.9%)
Quartzite	6	13	7	26 (2.2%)
Total:	**239**	**552**	**383**	**1174**

Table 5.5 shows the abrasion states for the three collections from Rietputs.

Table 5.5 Abrasion States for all 3 samples

State	COLLECTION 1		EXCAVATION		COLLECTION 2	
Slightly Abraded	239	20.4%	39	31.7%	25	11.1%
Abraded	552	47.0%	48	39.0%	91	40.4%
Very Abraded	383	32.6%	36	29.3%	109	48.4%
Total:	1174	100%	123	100%	225	100%

5.3 Flakes

The complete flakes at Rietputs were evaluated for technological type. Each was determined to be either corner struck, end struck or side struck. However, should the flake have other defining features (ie. core trimming flake), it fits that appropriate group. The majority of flakes is end struck (210), followed by corner struck (169), side struck (101) and core trimming (85). The flakes with the longest maximum length are core trimming flakes, with side struck flakes the second longest (Table 5.6).

Table 5.6 Technological flake types: average maximum length

Flake Type	**Average Maximum Length (mm)**
Core Trimming Flake	92.0
Corner Struck Flake	87.6
End Struck Flake	79.4
Side Struck Flake	89.4

The average maximum length of flakes made in the two main types of raw material used at Rietputs 15 is longer for those on Ventersdorp lava (Table 5.10 and Figure5.3). This fact is probably not because of the desire for longer flakes from the Ventersdorp lava. Rather, the coarse-grained composition of Ventersdorp lava is less easily controlled than hornfels and it mineral composition makes the lava much harder. Because it is harder a more powerful blow with is probably needed for flake removal. This might explain why flakes in Ventersdorp lava tend to be larger overall. However, the size and shape of clasts in the two raw materials also needs to be evaluated in this regard. Such analysis combined with experimental flaking would be needed to address this question.

Interestingly, there is a slight trend for hornfels is to be end struck and Ventersdorp lava flakes to be corner struck (Figures 5.4 & 5.5). This is probably related to the more tabular nature of the hornfels, versus the more angular clast shapes for Ventersdorp lava. Figure 5.4 also shows the trends in mean length for flake types by raw materials. It highlights the tendency for lava to produce longer flakes, and it also helps to visualize the size trends for the three main flakes types for each raw material. (Core Trimming Flakes can be excluded as they are less likely to be end-products.) The trends indicate that for both Ventersdorp lava and hornfels, the longest flakes are side-struck, followed by corner struck and end struck. There is also a very slight tendency for side-struck hornfels flakes to be longer than corner and end struck flakes (Fig. 5.6), which is probably related to a dominance of tabular clasts. Figure 5.7 shows the maximum length for flake types in Ventersdorp lava.

The rank order for flake types by raw material also shows some interesting trends (Fig. 5.8). For hornfels, the proportions are: end struck (41%), corner struck (24.4%), and side-struck (18%). For Ventersdorp lava, the proportions are: end struck (31%), corner struck (40%), and side-struck (18%). In other words, flakes in the two raw materials show opposite trends in the end and corner struck categories.

There are two possible explanations for this occurrence. First, the Vaal hornfels clasts tend to be very “slab-like” and tabular. This makes exploiting the largest surface for elongated flakes relatively simple, resulting in more end struck products. Secondly, Ventersdorp lava is commonly found as large angular boulders. This very hard raw material is best exploited by using large surface areas to produce large flakes or large chunks and flakes for core blanks. This could result in a greater variety of striking directions for flakes. Indeed, there is a difference of only 9% between the two categories for Ventersdorp lava, but a difference of 17% for hornfels.

5.4 Bifaces

The bifaces at Rietputs 15 play a potentially important role in the collection as there is such a large sample size for handaxes of early Acheulean age.

5.4.1 Handaxes

Handaxes were made on five different raw materials; chert, hornfels, quartzite, Ventersdorp lava and dolerite. The dominant choice of raw material was hornfels with Ventersdorp lava also frequently used (Table 5.7, Fig. 5.9). The handaxes on hornfels often display a flatter and less crude end product than those on Ventersdorp lava. This may be explained by the fact that hornfels is a softer and finer grained raw material which is easier to flake than Ventersdorp lava.

Table 5.7 Handaxe raw materials

Raw Material	Total Number	Percentage of Total
Ventersdorp lava	28	35.4%
Hornfels	44	55.7%
Chert	3	3.8%
Quartzite	3	3.8%
Dolerite	1	1.3%

There is a high number of handaxes in Collection 1 (N = 79 or 6.7%). This may be due to the fact that larger artefacts may have been less easily missed on the conveyer belts. Although every effort was made to obtain all artefacts, it has been acknowledged that larger ones may dominate.

Handaxes made on flakes are considerably more common than those made on cobbles (Tables 5.8 & 5.9). Fig. 5.10 shows that handaxes made on cobbles are slightly more variable in their length-width dimensions that those made on flakes, which is not unexpected. However, there is also a slight tendency toward larger length and width measurements for those handaxes that are abraded and very abraded (Figure 5.11). The slightly abraded handaxes have overall smaller dimensions. This could indicate a younger (less abraded) and more sophisticated component in the sample. However, the difference is minimal and abrasion states of artefacts in gravels are not necessarily indicative of age. It could also suggest that larger bifaces are more likely to survive longer in the gravels, which represent long-term accumulations of sediments for up to 400,000 years.

Handaxe lengths range between 8 and 24 cm, but most specimens fall within the 10 to 14 cm size range (Table 5.10). Handaxe length distributions are similar across the raw materials, but hornfels handaxes are generally smaller, with less distribution across the size intervals than the lava handaxes exhibit (Figures. 5.12, 5.13 and 5.14)

It is interesting to note the data in Table 5.9. The handaxes made on cobbles are greater in the hornfels category than in the Ventersdorp lava category. As Ventersdorp is found in large angular boulders, this leads way to striking large flakes to be used as the blank for LCTs. On the other hand, with hornels, its smaller tabular forms and fine grained make up may lend themselves to more LCT manufacture directly out of cobbles.

Table 5.8 Handaxe blanks

Raw Material Blank	**Number of Artefacts**	**Percentage of Total**
Cobble	23	29.9%
Flake	41	53.2%
Indeterminable	13	16.9%

Table 5.9 Handaxes on cobbles and flakes

	On Cobbles (N = 23) (29.9%)				On Flakes (N = 41) (53.2%)			
Raw Mat.	Total #	Slightly Abraded	Abraded	Very Abrad.	Total #	Slightly Abraded	Abraded	Very Abrad.
Venters. lava	7 (30%)	0	3	4	17 (41%)	2	8	7
Hornfels	15 (65%)	3	7	5	20 (49%)	2	15	3
Quartzite	0 (0%)	0	0	0	2 (5%)	1	1	0
Chert	1 (4%)	1	0	0	2 (5%)	0	2	0

Table 5.10 Percentage of handaxes inlLength groups (excluding dolerite)

Group	**All Raw Materials**	**Hornfels N = 41**	**Ventersdorp Lava N = 23**	**Chert N = 3**	**Quartzite N = 3**
80-99	10.4	17	3.3	0	0
100-119	31.2	31.7	19.5	33.3	66.6
120-139	31.2	34.1	30	33.3	0
140-159	14.3	9.8	23.3	0	0
160-179	7.8	4.9	6.6	33.3	33.3
180-199	2.6	2.4	3.3	0	0
200-219	1.3	0	3.3	0	0
220-239	1.3	0	3.3	0	0

5.4.2 Cleavers

"Cleavers are a sophisticated tool, which required planning and a special core preparation" (Ronen 2006). The cleavers at Rietputs are predominantly manufactured on large side struck flakes (Table 5.11 & Figures 5.15 and 5.16). This is a feature common to many early Acheulean assemblages.

None of the Rietputs cleavers is obviously made on cobbles. Although there are 10 cleavers on hornfels, 18 are made on Ventersdorp lava (Table 5.12). As stated before, this raw material is found in large angular clasts which may lend themselves to the removal of large side struck flakes easily knapped into cleavers. This contrasts with handaxes, the majority of which is made on hornfels.

Table 5.11 Cleaver's blanks

Flake	**Cobble**	**Indeterminable**
84%	0%	16%

Table 5.12 Cleavers abrasion state

Raw Material	**Slightly Abraded**	**Abraded**	**Very Abrade**	**Total Number**
Hornfels	2	8	0	10
Ventersdorp Lava	1	11	6	18
Quartzite	0	1	0	1

Of important note again is that the majority of cleavers are on Ventersdorp lava flakes (Table 5.11 and 5.12). This is consistent with the concept of large flakes being an important component of Acheulean technology (Sharon 2007). These flakes certainly play the biggest role in LCT (particularly cleaver and cleaver flake) manufacture in the Victoria West Acheulean industry of a slightly younger date.

5.4.3. Picks

Also in keeping with the nature of most Early Acheulean assemblages in Africa, picks are a very prominent component of the Rietputs collection (Fig. 5.17). There are 37 formal tools classed as picks, which is more numerous than the cleavers (N=29).

5.5 Excavation Results

The small excavation sample ensures the smaller component of the collection exists in the gravels even though it is missing from the collection. 123 artefacts were excavated (Table 5.13).

Table 5.13 Artefacts from Rietputs excavation

Artefact	Number
Chunk	2
Core Trimming Flake	3
Corner Struck Flake	23
End Struck Flake	49
Flake Fragment	22
Incomplete Flake	4
Irregular Core	1
Polyhedral Core	2
Scraper	1
Side Struck Flake	10
Split Cobble	1
Split Flake	5
TOTAL	**123**

Although artefacts <30mm are present in the excavated sample, it is still only a small percentage (23%) (Table 5.18), which is consistent with higher energy alluvial sites. The average artefact size from the excavation is 45mm.

Table 5.14 Excavation artefact size distribution.

Size Category	**Total Number of Artefacts**	**Percentage of Collection**
10-19 mm	4	3.3%
20-29 mm	25	20.3%
30-39 mm	27	22.0%
40-49 mm	24	19.5%
50-59 mm	24	19.5%
60-69 mm	10	8.1%
70-79 mm	4	3.3%
80-89 mm	1	0.8%
90-99 mm	1	0.8%
100 and higher mm	3	2.4%
Total	**123**	**100%**

A primary reason for excavation was to determine if the small component of artefacts, not retrieved in Collection 1, may be present in the deposits. Indeed it can be seen that certainly smaller artefacts are more prominent in the excavation than the mining sample, but Collection 1 still is a highly representative sample.

5.6 Collection 2

The purpose of Collection 2 was to obtain a sample from a different part of the Rietputs Formation gravels in Windsorton (Figure 1.2), which was several hundred metres distant from Collection. 1 it may have a slightly different date. Dating samples have been obtained and should they be processed a detailed study of the corresponding technology could be valuable. However, the Collection 2 sample is small (N=225) and it was decided not to included it in the detailed analysis.

5.7 Conclusions from collection analyses

The analysis of the collection has displayed a number of interesting points as discussed above. First of all it is worthy of mention that the Rietputs 15 collection shows a high degree of knapping skill within its biface manufacture.

For example, the handaxes at Rietputs 15 have an overall tendancy to be made on flakes. However, when a handaxe is made on a cobble, it is more likely to be on hornfels than Ventersdorp lava. This may be due to the ‘slab-like’ morphology of natural hornfels in the area, thus displaying a solid knowledge in procurement of raw material.

In addition almost all cleavers are made on large flakes (mostly side struck). A high amount are made on Ventersdorp lava (N=18). This fact is due to the angular cobble of natural lava and the ability to exploit it for large flakes which can then be manufactured into bifaces such as cleavers.

At Rietputs 15, though the collection is from a conveyer belt (Figure 5.18), 60% of the entire collection is made up of flakes and flaking debris. This suggests that for the first time we have a more honest representation of an entire assemblage from the Rietputs gravels.

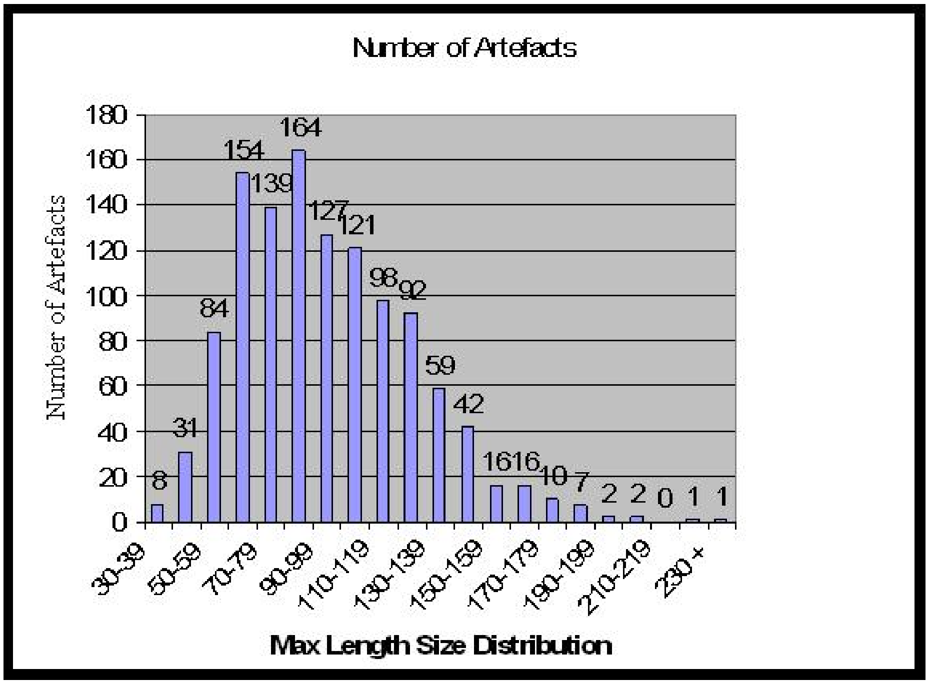

Figure 5.1 Total artefact maximum length

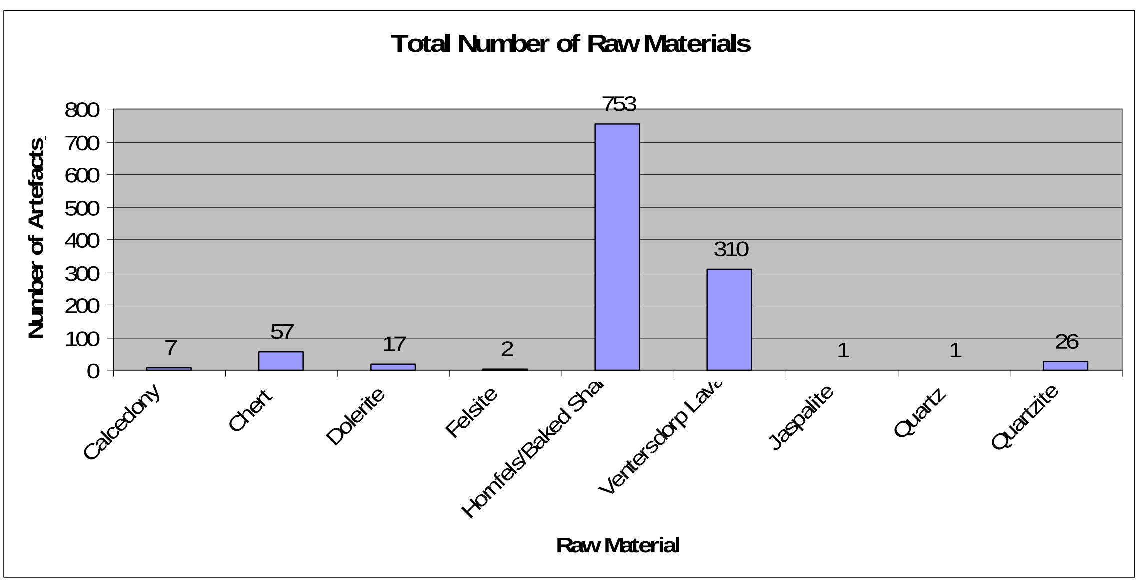

Figure 5.2 Collection 1 raw material

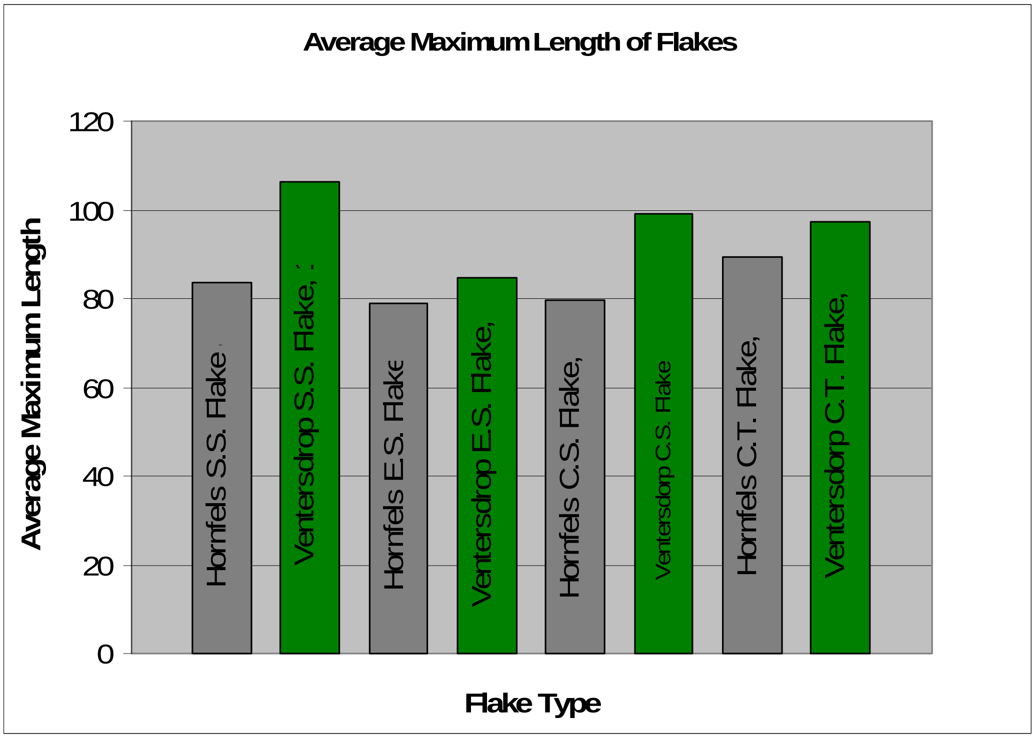

Figure 5.3 Average maximum length of hornfels and Ventersdorp lava flake types

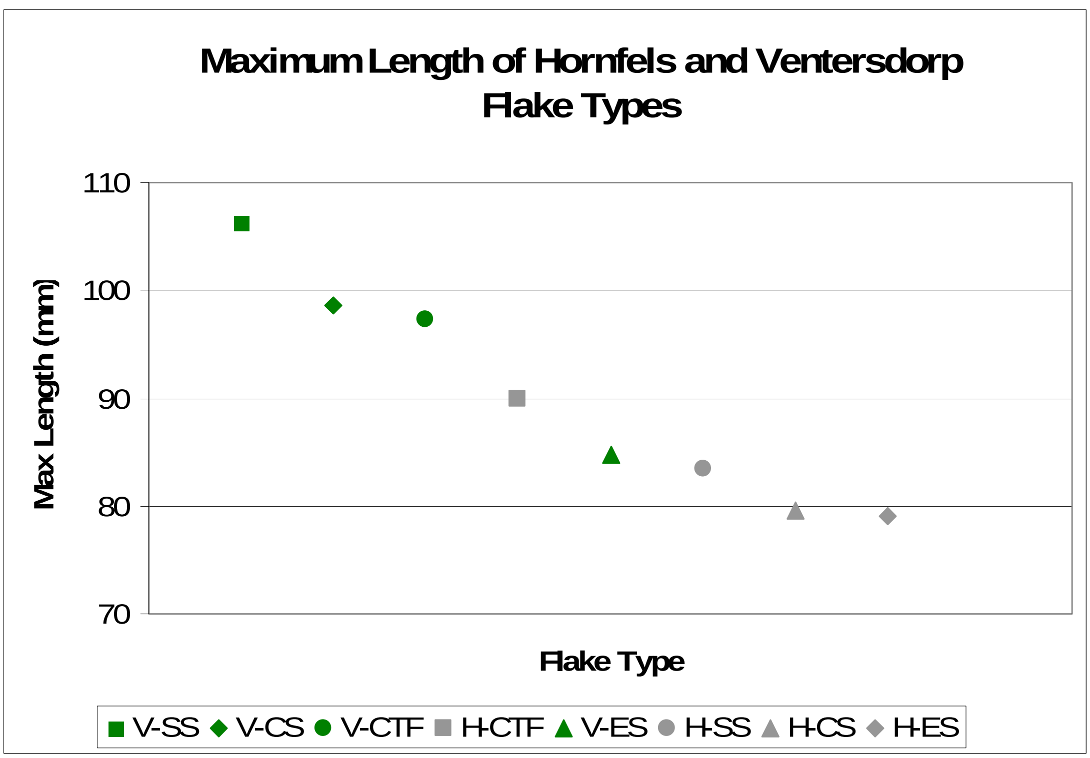

Figure 5.4 Ventersdorp lava and hornfels flake types maximum length

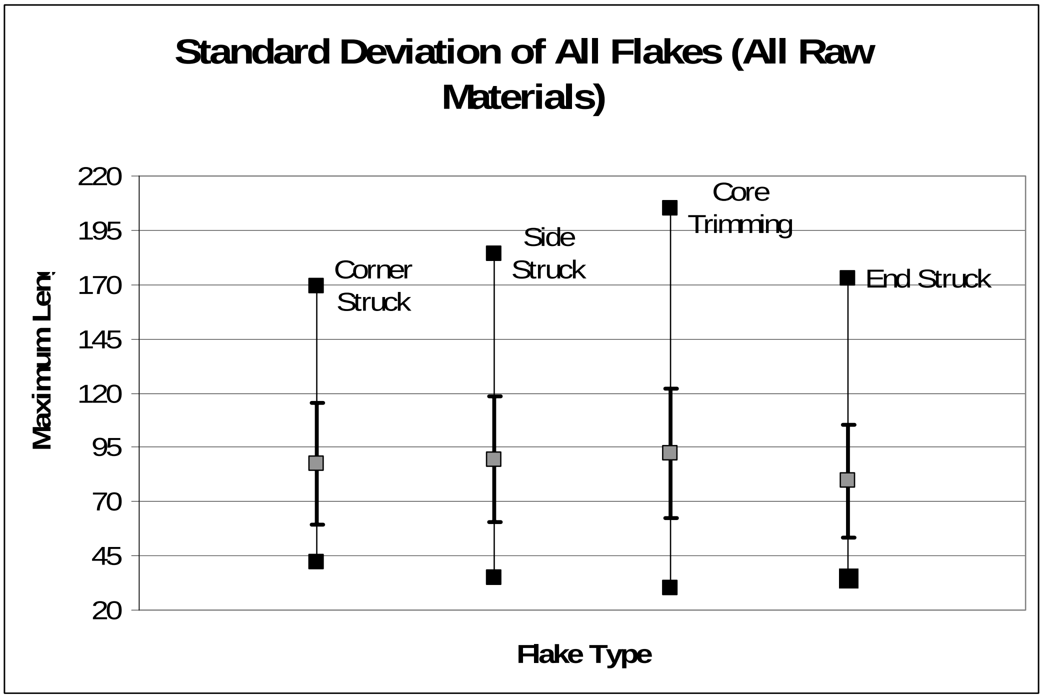

Figure 5.5 Maximum lengths of all complete flakes, showing means, standard deviations and range for each type.

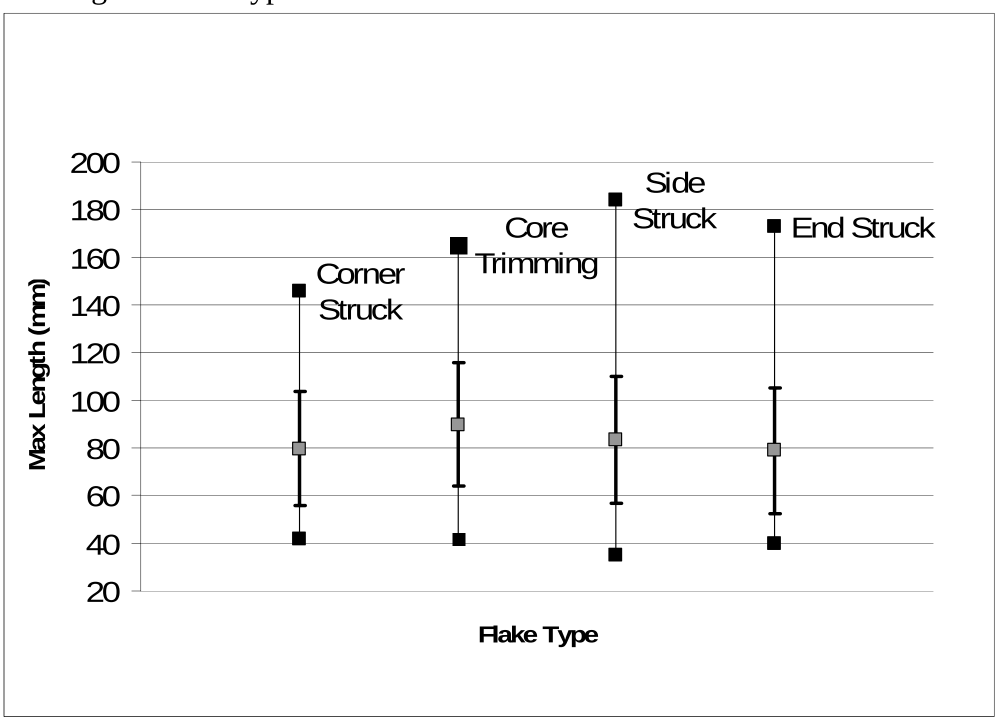

Figure 5.6 Maximum lengths for flake types in hornfels, showing means, standard deviations and range for each type.

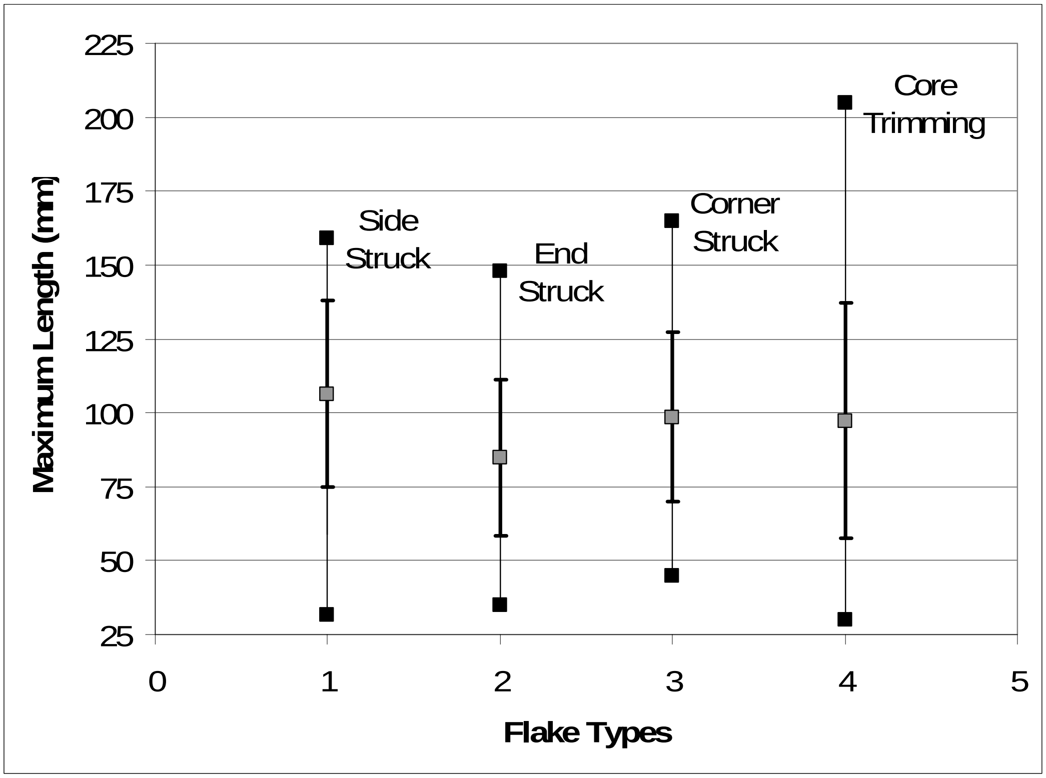

Figure 5.7 Maximum lengths for flake types in Ventersdorp lava, showing means, standard deviations and range for each type.

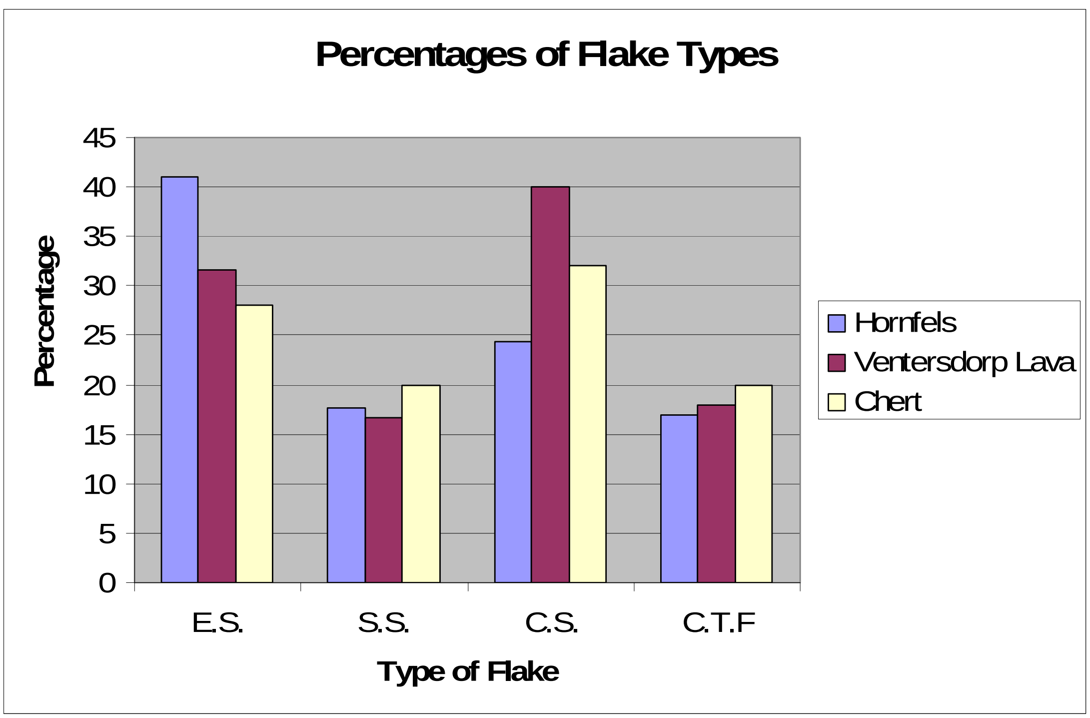

Figure 5.8 Flake types by raw material

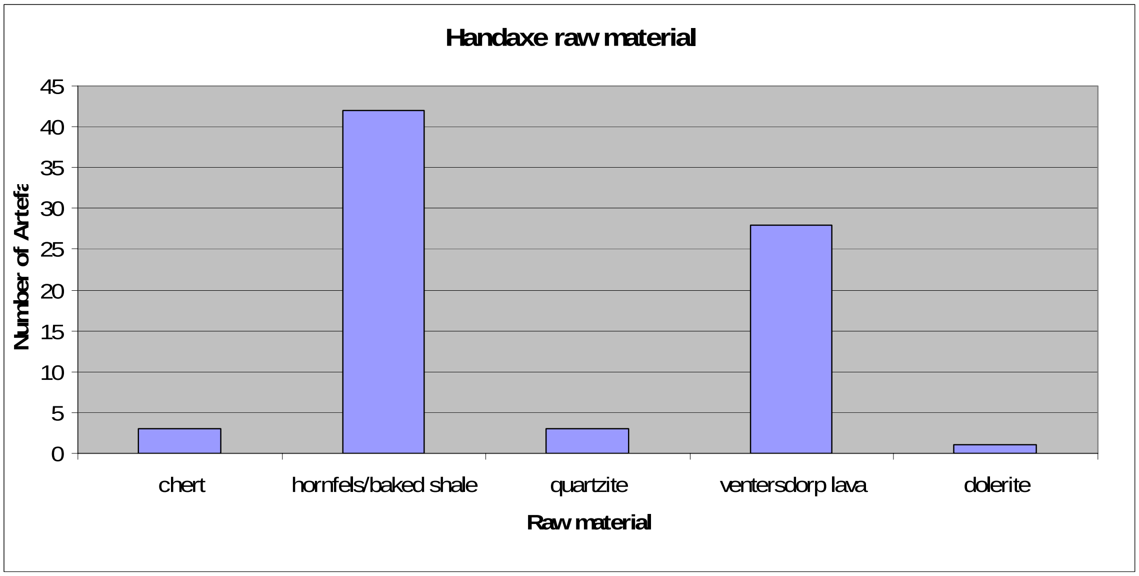

Figure 5.9 Raw materials of handaxes

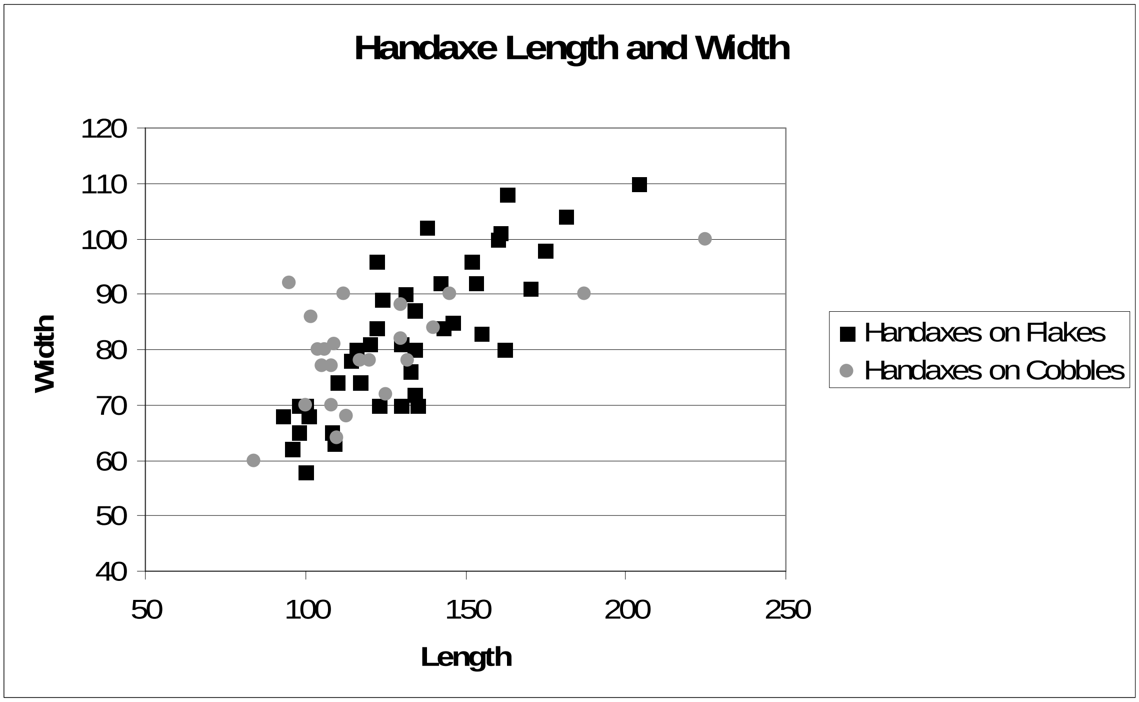

Figure 5.10 Distributions of handaxe length and width

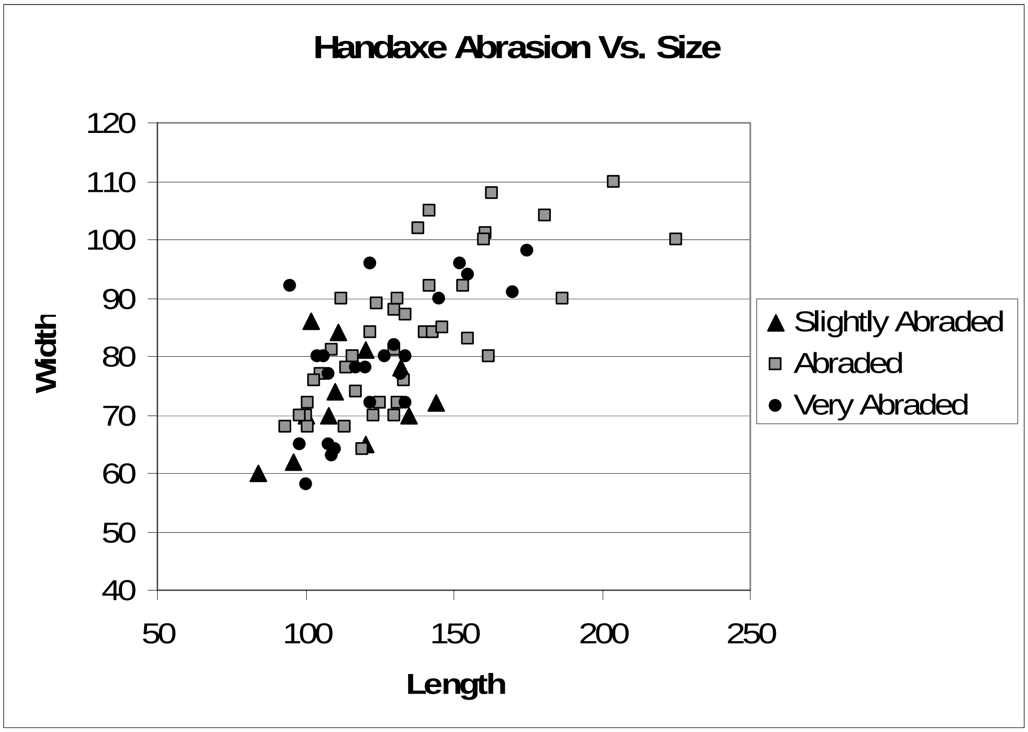

Figure 5.11 Handaxe abrasion vs. size

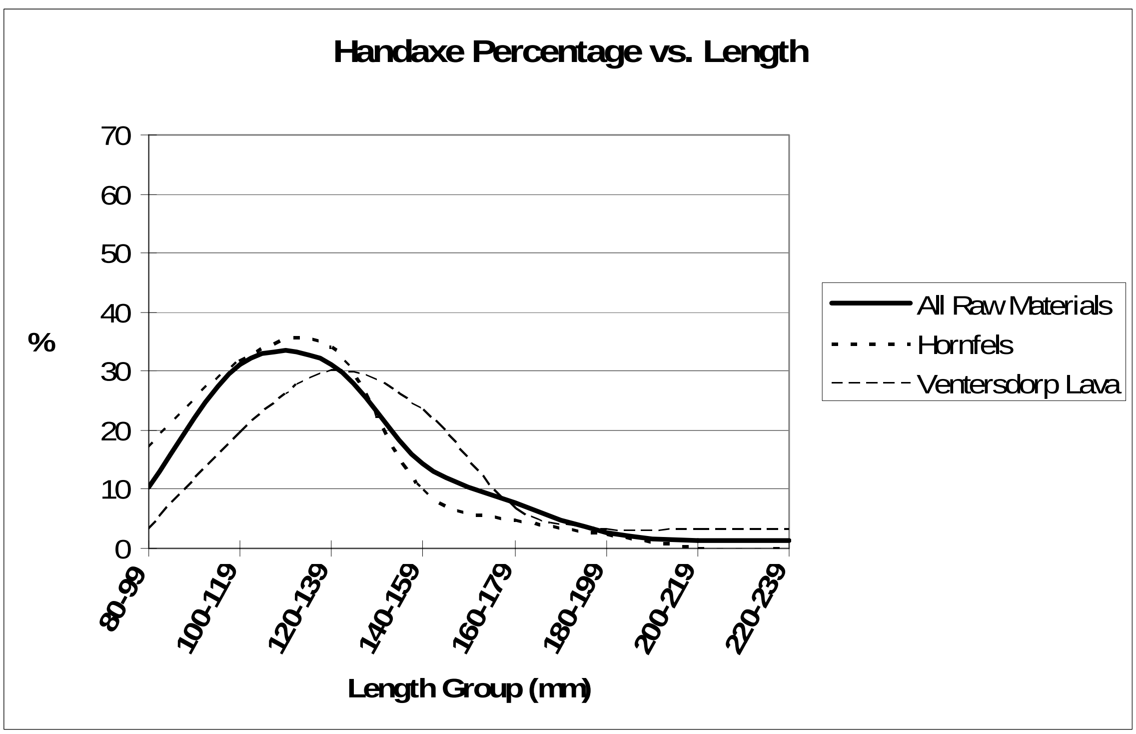

Figure 5.12 Size distribution of handaxes by raw materials

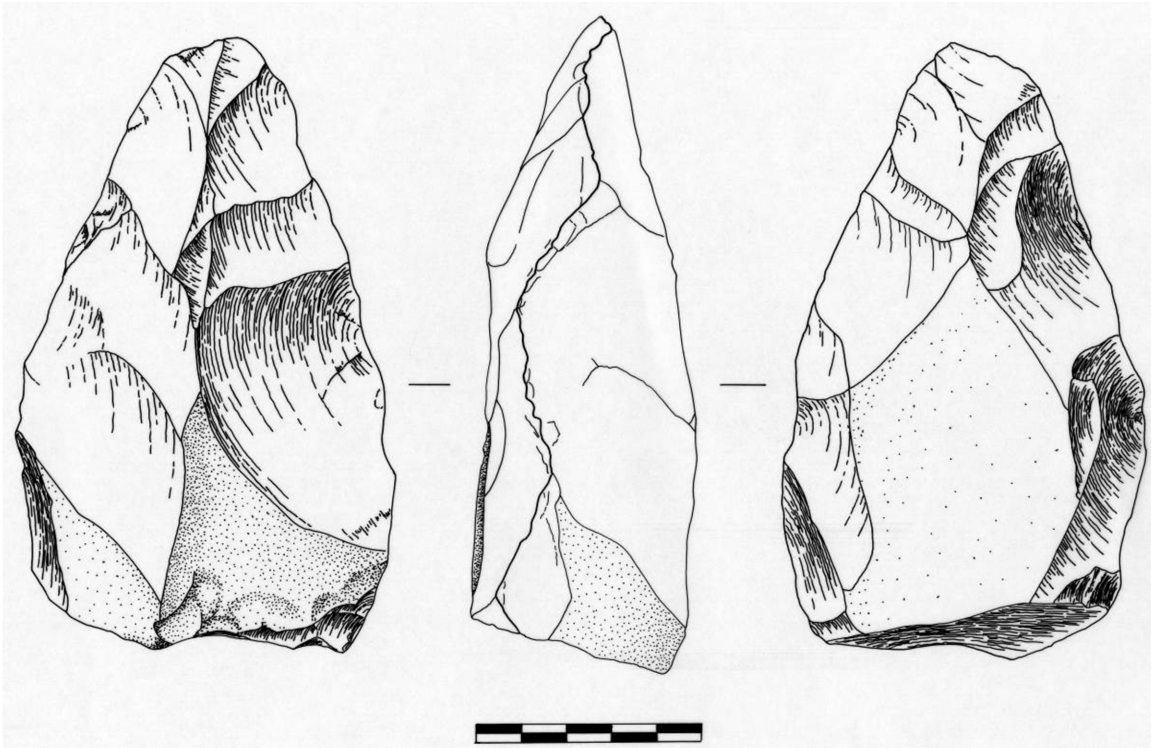

Figure 5.13 Bifacial handaxe on a cobble on hornfels

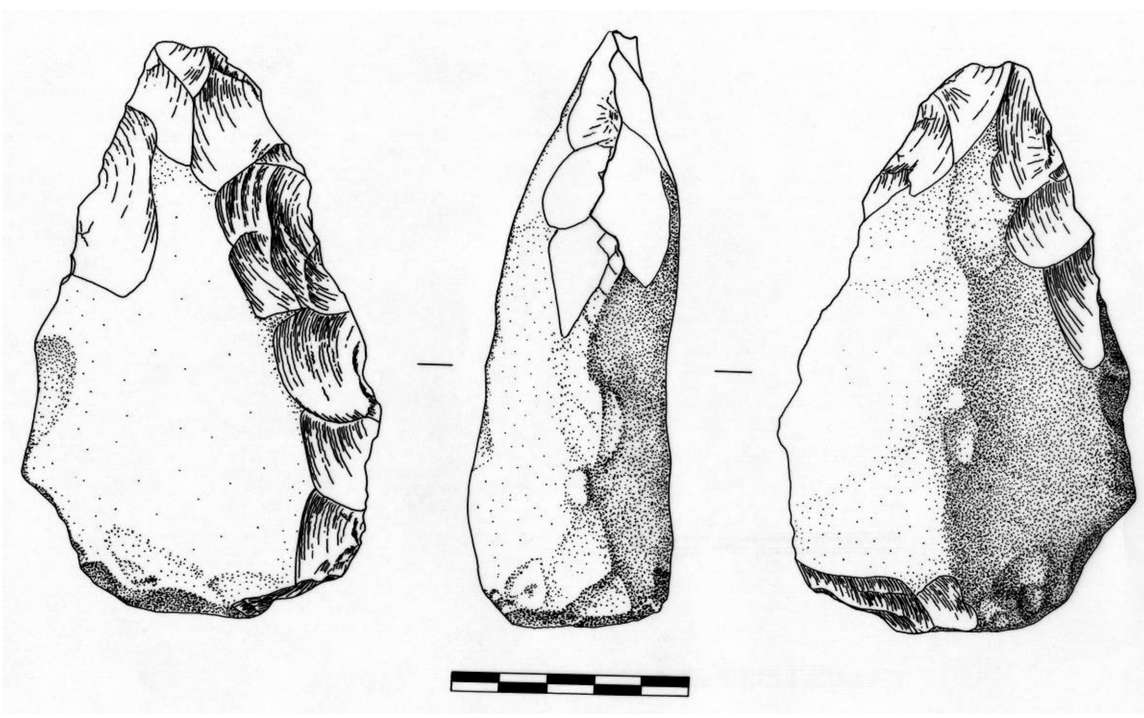

Figure 5.14 Bifacial handaxe on a cobble on hornfels

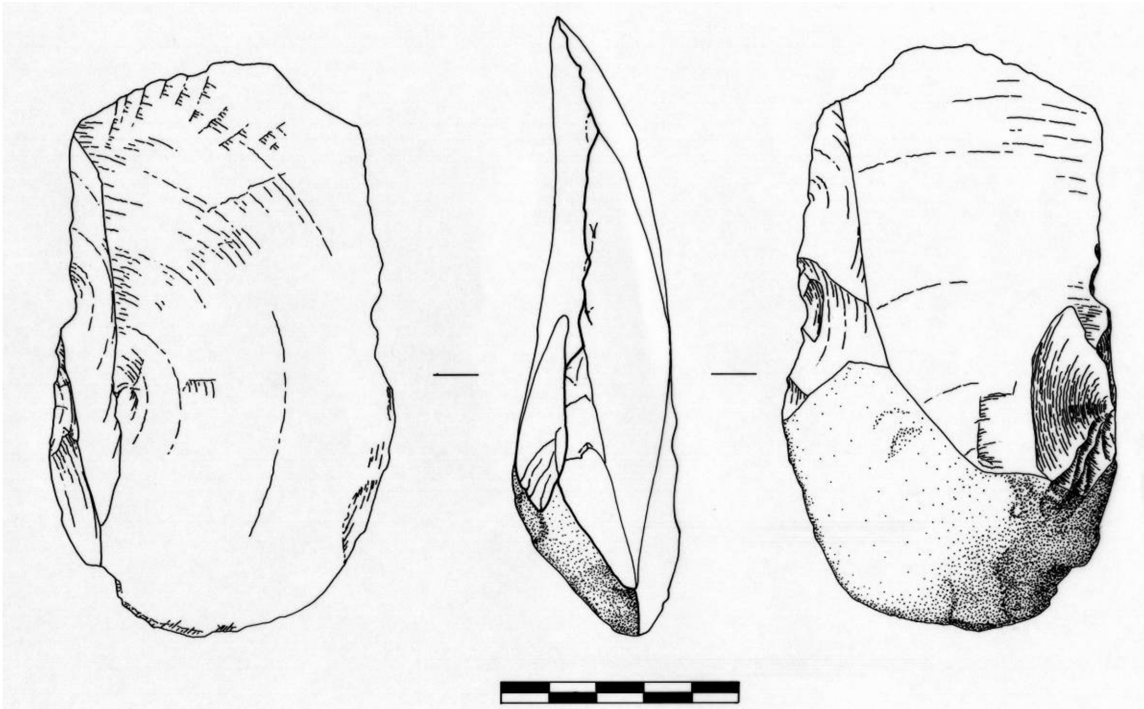

Figure 5.15 Cleaver on a side struck flake on Ventersdorp lava.

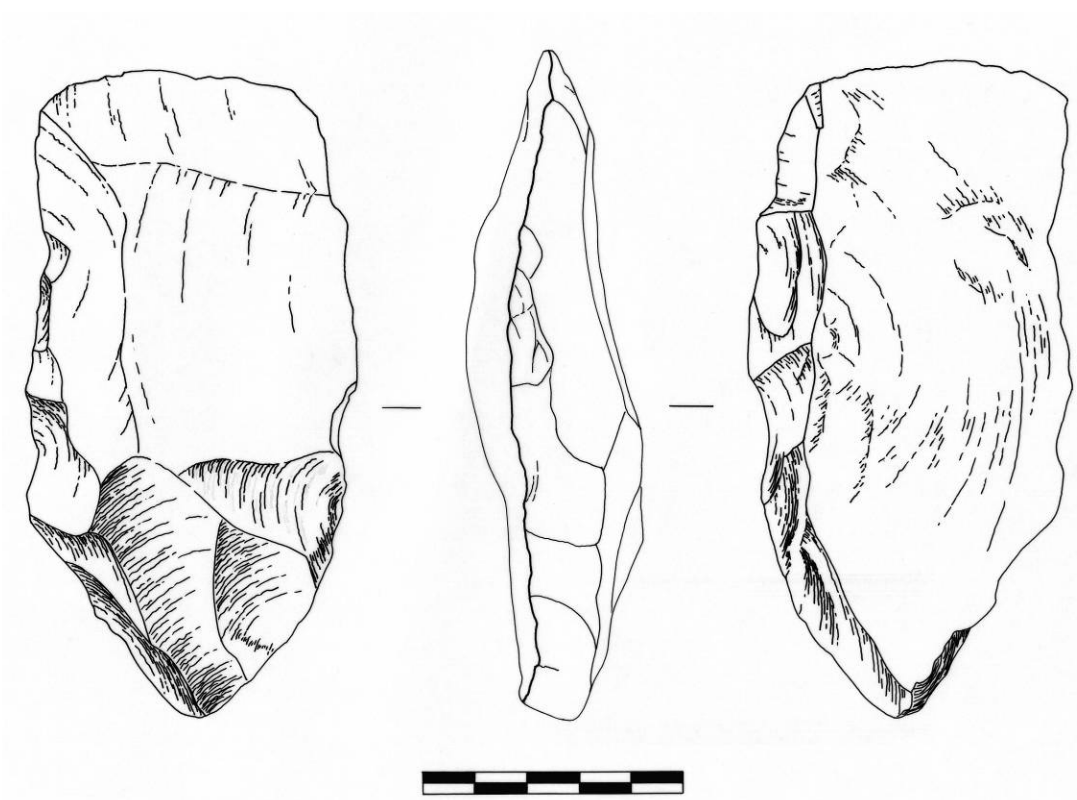

Figure 5.16 Cleaver on a side struck flake on Ventersdorp lava.

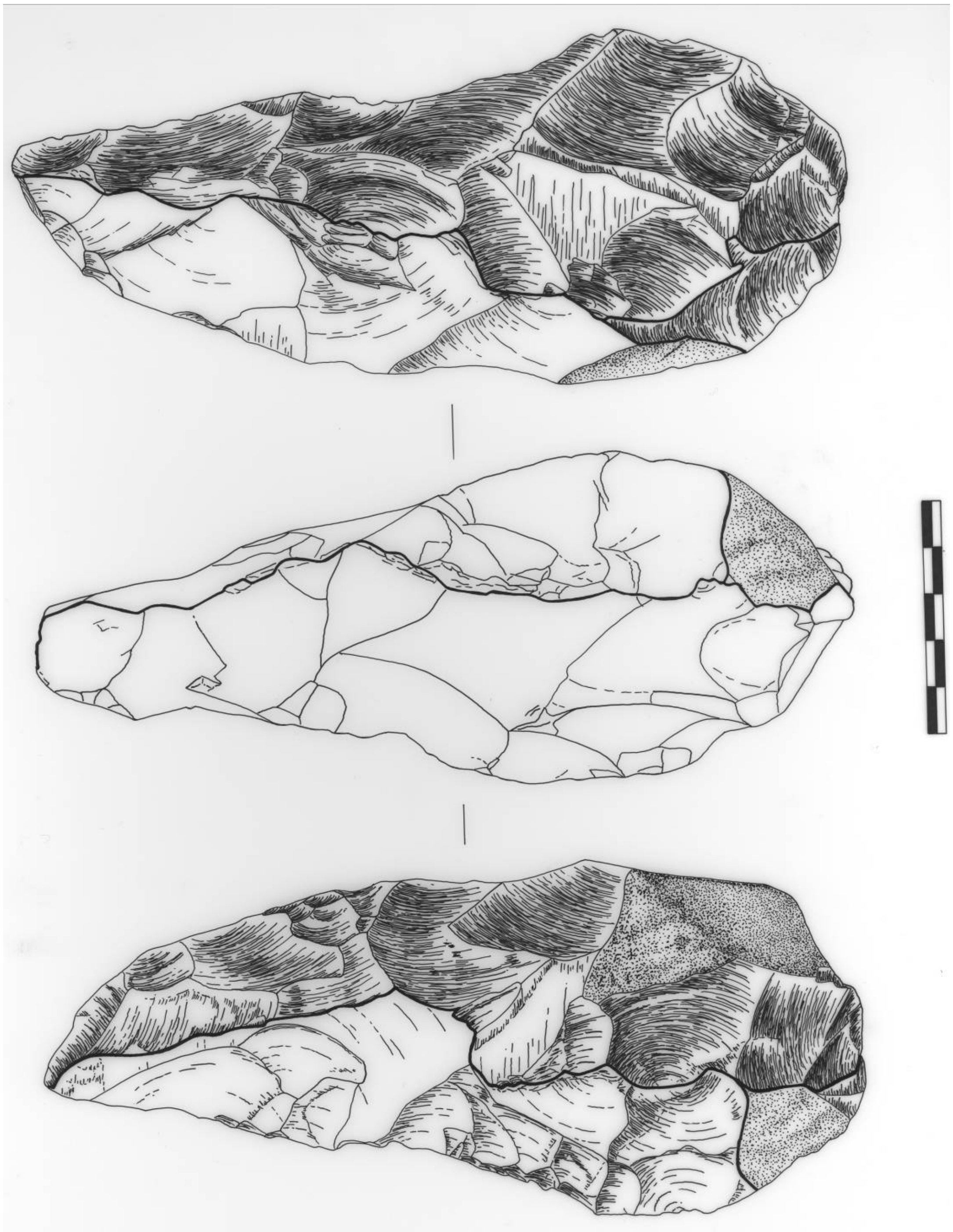

Figure 5.17 Pick on a hornfels cobble

Figure 5.18 Collecting tools from the conveyer belt at Rietputs 15.

CHAPTER 6: CORE FLAKING STRATEGIES

6.1 Introduction

Simple Strategies dominate the collection at 56% of all core flaking patterns (Table 6.1). The six core types placed in this category are interpreted as strategies which are largely opportunistic. Flaking follows the natural convexities of the blank and often the original form is still detectable in the discarded core. Centripetal Strategies (24%) may also be considered a simpler, more opportunistic approach to flaking. They are present in even the earliest Oldowan assemblages (e.g., Semaw 2000) and usually represent the easiest means of removing flakes from their particular blanks. Organised Strategies, however, make up a substantial 20% of the 322 cores and indicate an attempt to flake or create large surfaces (Table 6.1). Of these 64 cores, 86% have asymmetrical properties. The importance of the Organised Stategy cores is highlighted by the fact that they form 5.5% of the entire collection.

The interpretation of organised flaking strategies in the Early Acheulean can be viewed as rather subjective. Therefore it remains a difficult task to make generalizations, particularly as most assemblages have been published without detailed reference to flaking strategies, with de la Torré *et al.* (2003) being the exception. For Rietputs 15, we propose several groups with different degrees or form of organization, which contrast with 80% of the cores with simple exploitation patterns. As the site lacks refitting data, all the analysis of the cores' degree of organisation has come from the end products. The constraints of a traditional core classification scheme (e.g., Leakey 1971's typology) were deemed too tight to allow an adequate description of the more organized core attributes at Rietputs. It was therefore decided to create five descriptive sub-categories of organised cores, in a manner like that undertaken for the Oldowan site of Omo, Ethiopia (de la Torre 2004).

Such a classification scheme better allows us to appreciate a toolmaker's predetermined notion of the end products needed, *ie.* large flakes as a goal of knapping. As far back as the Oldowan, it is suggested that hominids may have had a predetermined idea of the final product's morphology (Delagnes and Roche 2005; Toth 1985). During the Early Acheulean, hominids were selecting raw materials more carefully than previously (Clark 1980; Feblot-Augustins 1990; Jones 1994; McBrearty and Tryon 2006; Merrick *et al* 1994; Raynal *et al.* 1995). The Organised Strategies devised for this study are an attempt to document this observation.

Table 6.1 Flaking strategies (excluding core fragments)

Strategy Type	**Core Type**	**Total**	**% of Specific Strategy Type**
Simple Strategies 56% (N = 180)	Boulder	1	1%
	Casual	3	2%
	Single Platform	8	4%
	Irregular	53	29%
	Polyhedral	34	19%
	Chopper	81	45%
Centripetal Strategies 24% (N = 78)	Discoid	34	44%
	Radial/Subradial	44	56%
Organised Strategies 20% (N = 64)	Asymmetrical Discoid	4	6%
	Asymmetrical with Preferential Removal	25	39%
	Asymmetrical with Preferential Surface	10	16%
	Elongated Asymmetrical Exploitation	16	25%
	Largest Surface Exploitation	9	14%

6.2 Classification of organised flaking strategies

At Rietputs 15 the more organised exploitation strategies are described as follows:

6.2.1 Group 1: Asymmetrical Discoid Cores

Asymmetrical Discoid Cores (N = 4; Figs. 6.1 & 6.2). The cores in this group display a basic relationship between a pyramidal underside and an upper surface with much less volume. Although the upper surface has removals on it, they are not necessarily indicative of a preferred surface. The underside of the core may be equally important to the knapper for the removal of flakes. As there are only four of these types, it is not evident if they were intentionally knapped to create the asymmetrical shape or if the the asymmetry was influenced by the natural shape of the blank. The upper surfaces of two of the four cores are flat (Fig. 6.1), but two are more angled (Riet 1115 and Riet 161, see Figure 6.2).

Table 6.2 Group 1 cores abrasion states

Raw Material	Slightly Abraded	Abraded	Very Abraded	Cortex Y/N
Hornfels (N = 3)	3	0	0	0/3
Ventersdorp (N = 1)	0	1	0	1/0

Figure 6.1 Asymmetrical Discoid. On hornfels, No.Riet 626

Figure 6.2 Asymmetrical Discoid Core. On lava with pyramidal underside and flatter but still slightly angled upper surface.

6.2.2 Group 2: Asymmetrical Cores with Preferential Removal

Asymmetrical Cores with Preferential Removal (N = 25; Figs. 6.3 to 6.6). The cores placed in this group display the same type of asymmetry as found in Group 1 However, the top surface is always relatively flat and shows the negative of a large, final, preferential removal which is struck largely parallel with the surface rather than at an angle. The consistency of this removal on cores in this group emphasizes its importance to the knapper. In addition the large number of Group 2 indicates that the final removal is not typically accidental but often a deliberate goal of the knapper. Two of the cores also have certain platform preparation, Riet 96 and Riet 776 (Figures 6.3 and 6.6).

Table 6.3 Group 2 cores abrasion states

Raw Material	Slightly Abraded	Abraded	Very Abraded	Cortex Present/Absent
Hornfels (N = 23)	4	11	8	11/12
Ventersdorp (N = 2)	1	1	0	1/1

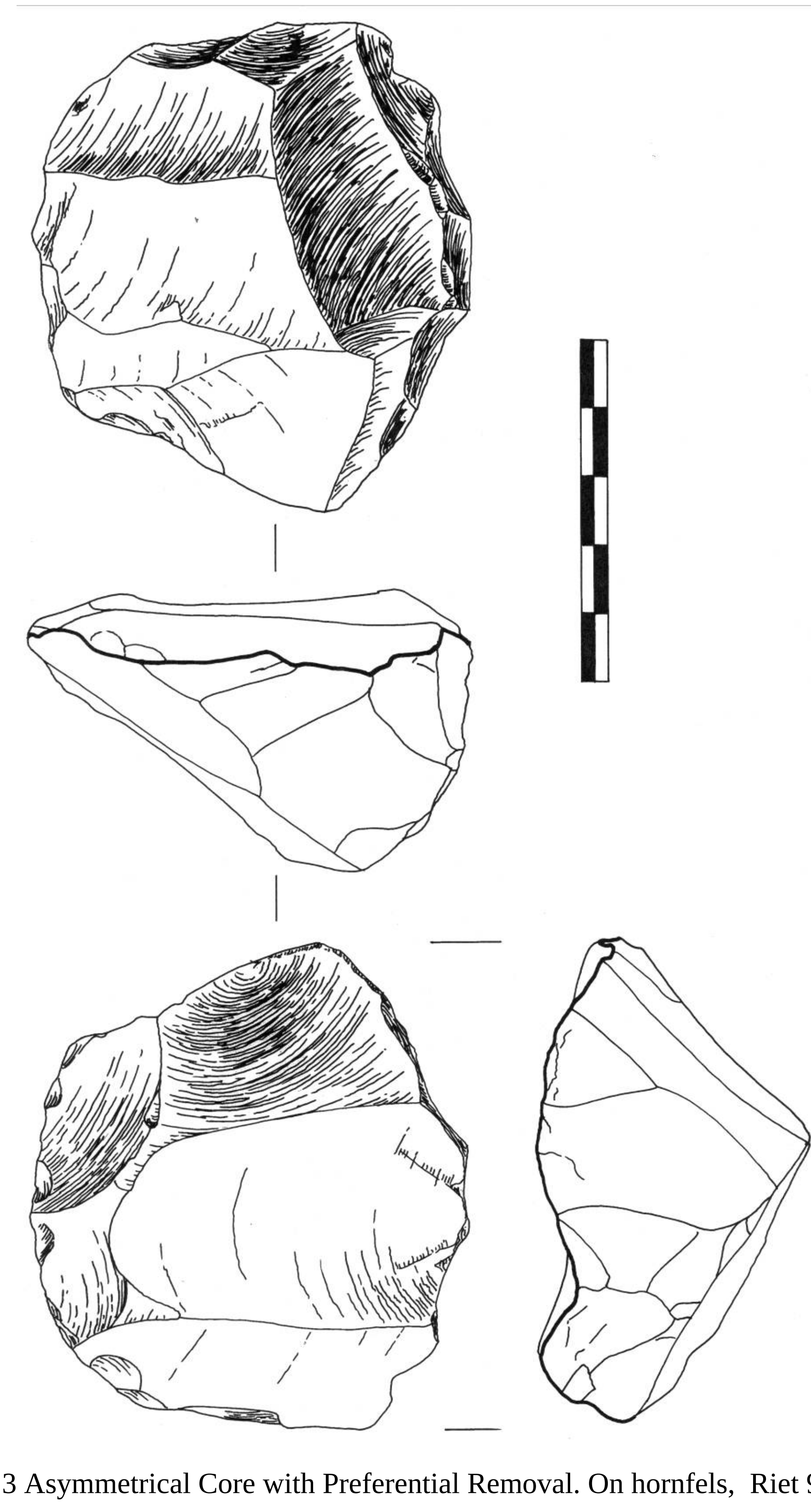

Figure 6.3 Asymmetrical Core with Preferential Removal. On hornfels, Riet 96

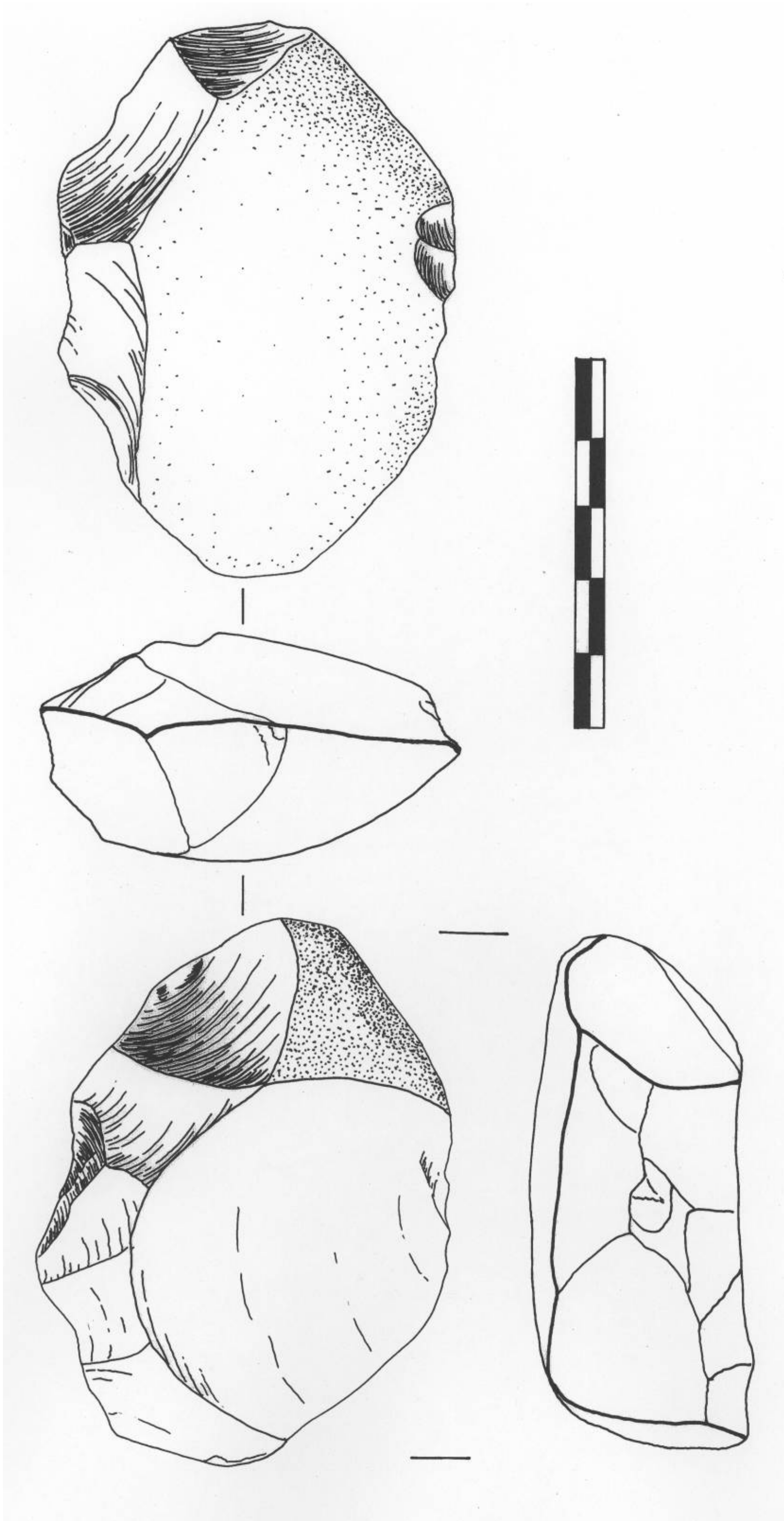

Figure 6.4 Asymmetrical Core with Preferential Removal. On hornfels, Riet 947.

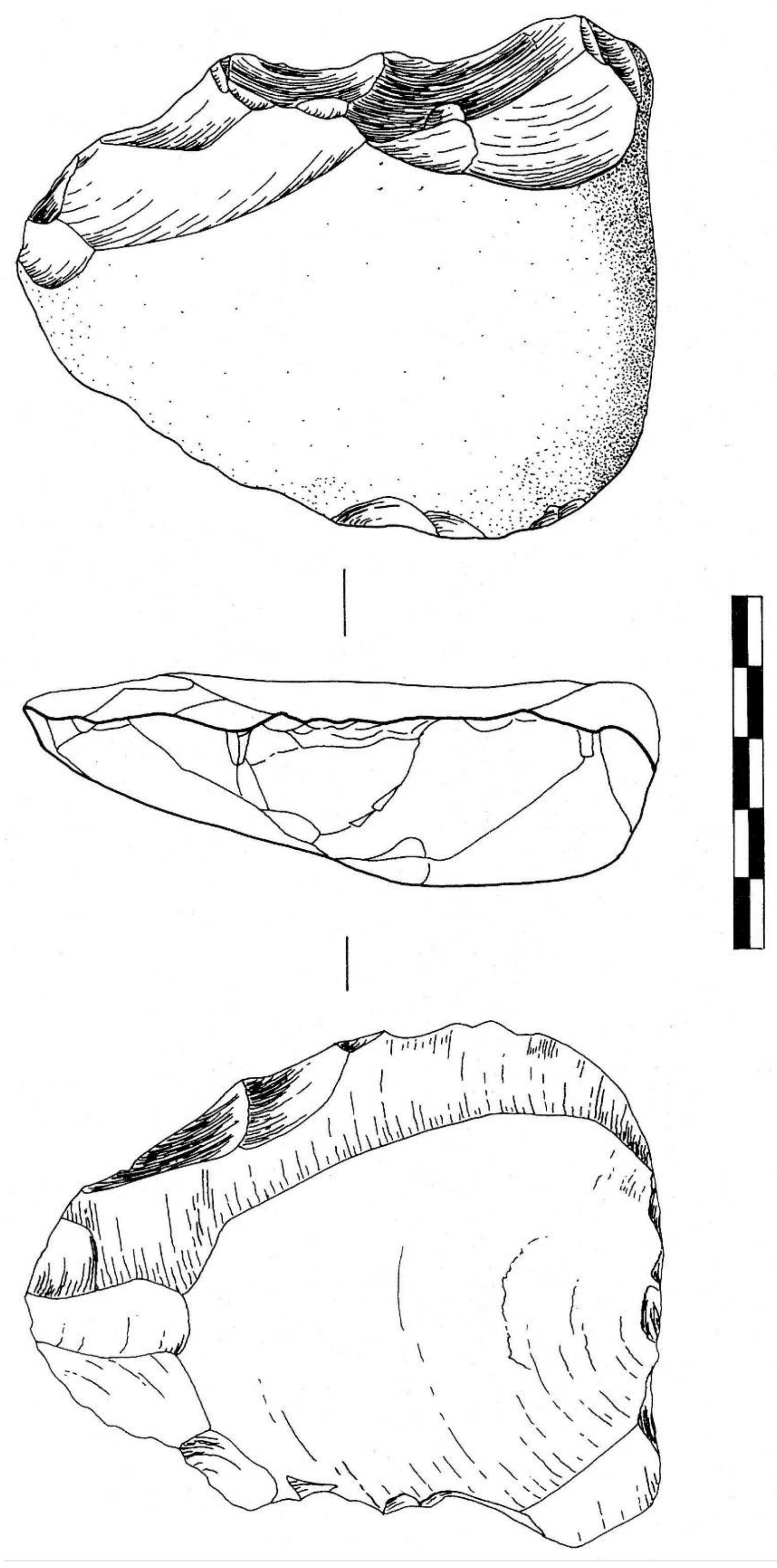

Figure 6.5 Asymmetrical Core with Preferential Removal. On hornfels, Riet 760

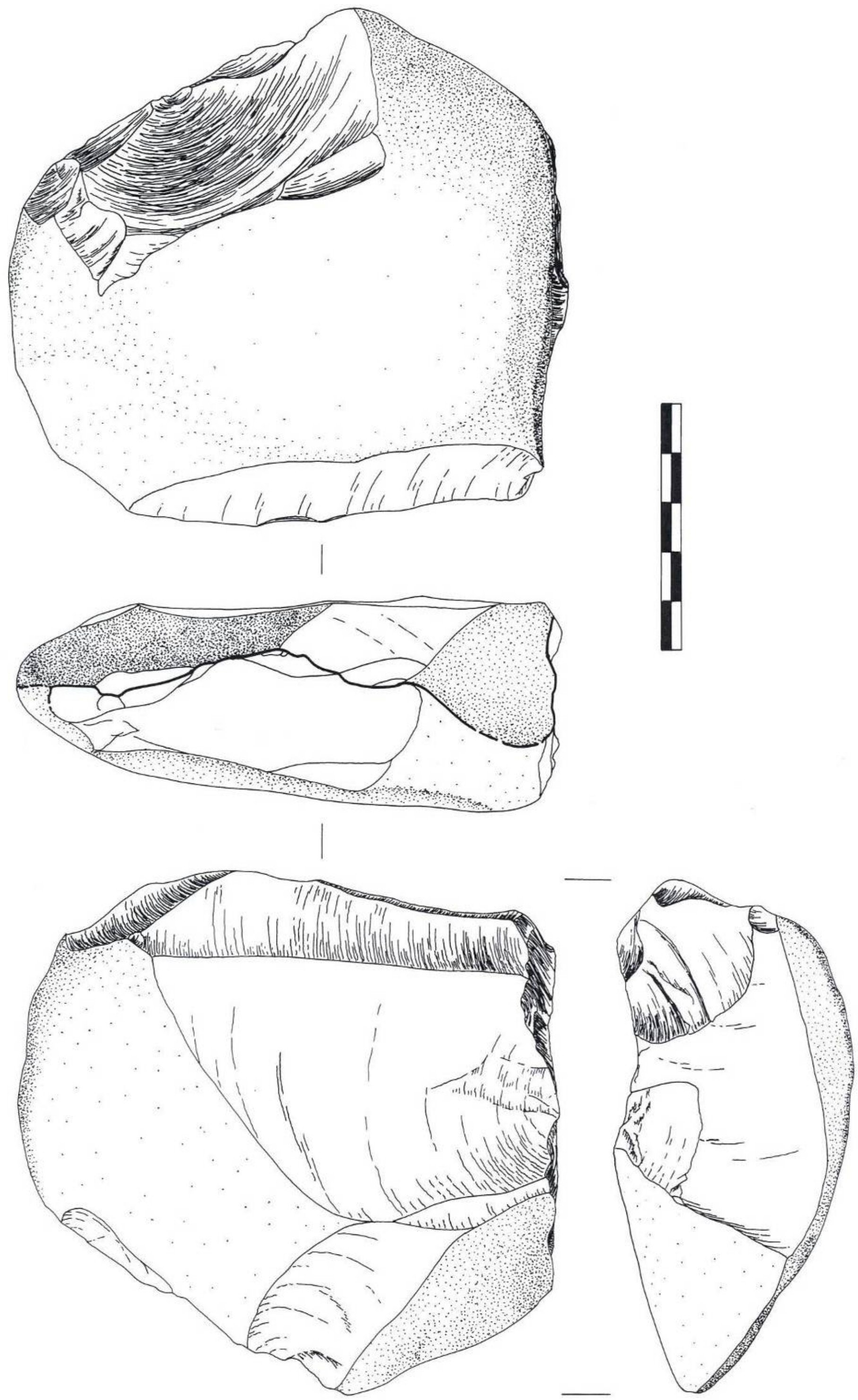

Figure 6.6 Asymmetrical Core with Preferential Removal. On hornfels, Riet 776.

6.2.3 Group 3: Asymmetrical Cores with Preferential Surface

Asymmetrical Cores with Preferential Surface (N = 10; Fig. 6.7). Cores in this group display the same asymmetrical properties as in Groups 1 and 2. However, rather than one large removal on the upper surface, these cores have more than one removal. The emphasis is certainly on the flat upper surface rather than the pyramidal underside. They differ with asymmetrical discoids in having a flatter upper surface dominated by removals that are largely parallel to this surface.

Table 6.4 Group 3 cores abrasion states

Raw Material	Slightly Abraded	Abraded	Very Abraded	Cortex Present/Absent
Hornfels (N = 8)	3	5	0	2/6
Ventersdorp Lava (N = 2)	0	2	0	1/1

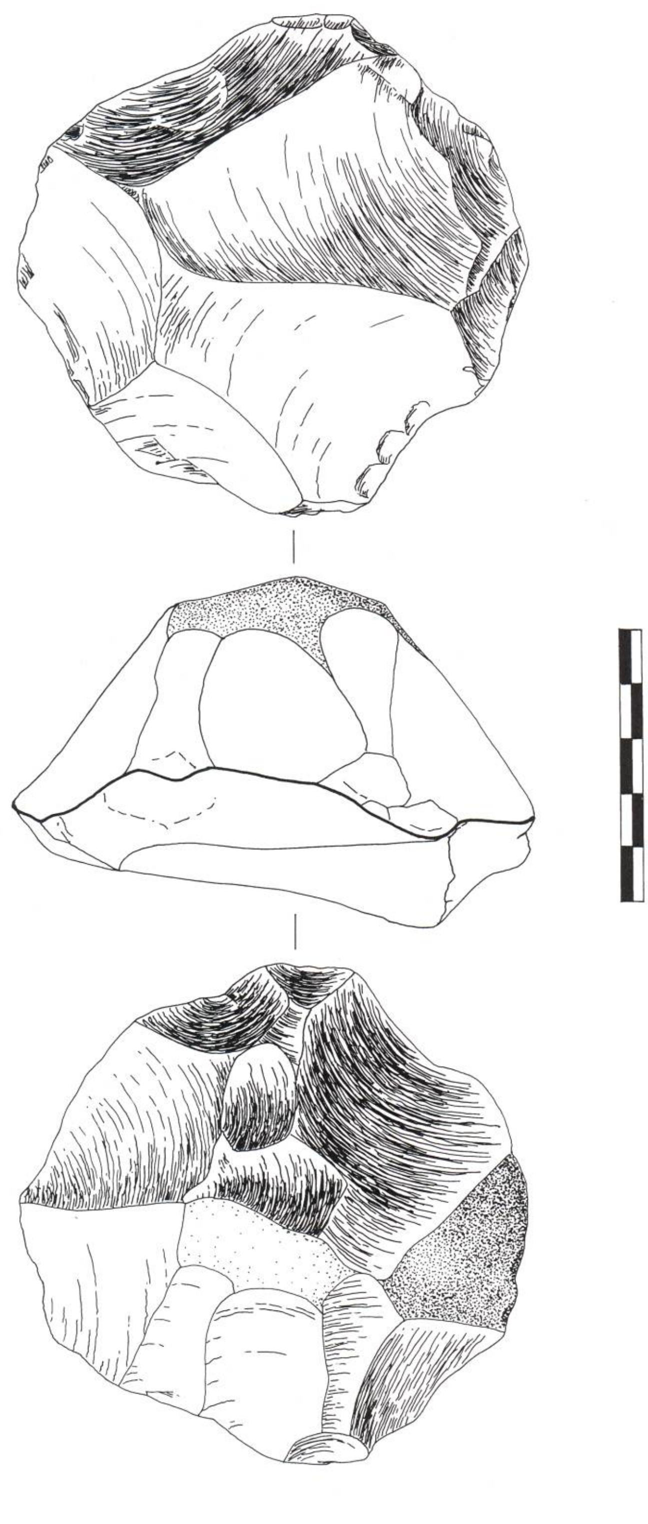

Figure 6.7 Asymmetrical Core with Preferential Surface. On Ventersdorp lava. Riet 1075.

6.2.4 Group 4: Elongated Cores with Asymmetrical Exploitation

Elongated Cores with Asymmetrical Exploitation (N = 16; Figs. 6.8 & 6.9). These cores have asymmetrical and hierarchically related faces with a flatter upper surface as in Group 3 , but in plan view they have a shape approaching that of bifaces. The length is assessed as approximately a third longer than the width. This form suggests that there was a developmental link between the production of handaxes and the realization that large flakes could be obtained from a face with the right contour during the knapping sequence. Two of the cores have large lateral removals and anticipate the more organised shapes of the younger Victoria West prepared cores designed to produce a single large side struck flake (McNabb 2001).

Table 6.5 Group 4 core abrasion states

Raw Material	Slightly Abraded	Abraded	Very Abraded	Cortex Present/Absent
Hornfels (N = 11)	5	5	1	6/5
Chert (N = 2)	1	0	1	2/0
Calcedony (N = 1)	0	1	0	1/0
Ventersdorp (N = 2)	1	1	0	2/0

Such cores occur in four raw materials, although there are only three specimens in crypto-crystalline rock (chert and chalcedony) and 2 in Ventersdorp lava. 69% are made in hornfels, suggesting that the slab-like blanks common for this material were easily exploited in an asymmetrical flaking strategy.

Figure 6.8 Elongated Core with Asymmetrical Exploitation. On hornfels, Riet 891. The upper surface is shown in the first view at left and the lower surface in the middle view. The profile view at right shows the developed asymmetry.

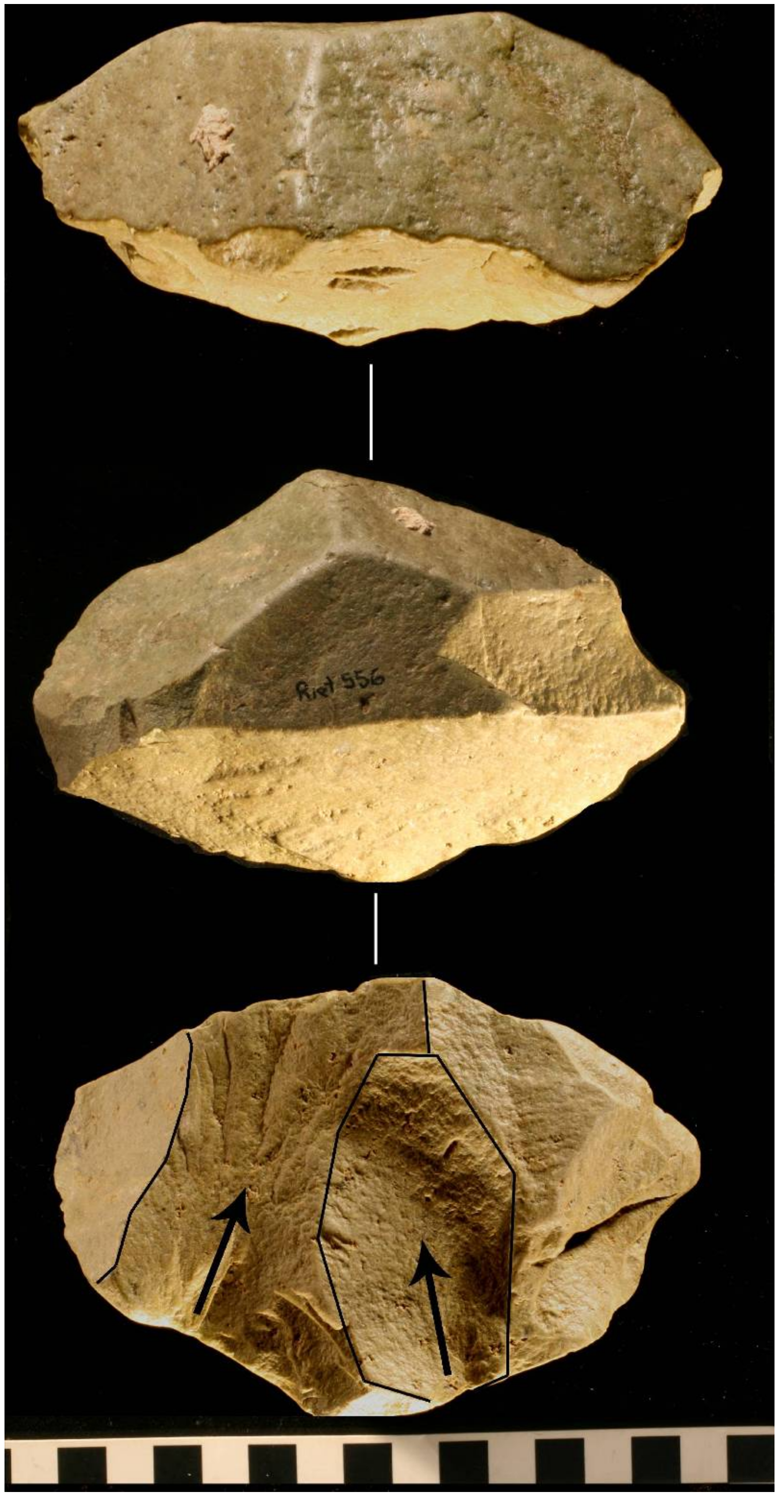

Figure 6.9 Elongated Core with Asymmetrical Exploitation. On Ventersdorp lava, Riet 556. The left view is the upper surface with two large removals as indicated. The middle view is the steeper under-surface. The right view is shown at a three-quarter angle, with the flatter upper surface to the left of the midline.

6.2.5 Group 5: Cores with Largest Surface Exploitation

Cores with Largest Surface Exploitation (N = 9; Figs. 6.10 & 6.11). These are largely single platform cores which produced elongated (blade-like) flakes. The largest or most easily accessible face of the core is exploited for the elongated removals. There is minimal working on the remainder of the core, leaving many cores largely cortical. All are produced on cobbles rather than on large flakes from boulder cores, and all but one are made in hornfels. This suggests the blanks were selected for the angular shape suitable for quick and easy knapping of elongated flakes.

Table 6.6 Group 5 cores abrasion states

Raw Material	Slightly Abraded	Abraded	Very Abraded	Cortex Present/Absent
Chert (N = 1)	1	0	0	1/0
Hornfels (N = 8)	3	5	0	7/1

Figure 6.10 Core with Largest Surface Exploitation. On hornfels, Riet 460.

Figure 6.11 Core with Largest Surface Exploitation. On hornfels, Riet 448.

6.3 DISCUSSION

The collection from Rietputs 15 clearly displays the need for re-evaluation of Early Acheulean core technology. It demonstrates that there may be a higher level of organisation in the core reduction strategies at this early period than previously noted. The main defining features of the cores that show organised flaking properties are the consistency of the asymmetry found in the core end-product and the exploitation of the largest, most easily accessible surface. This is not mere chance; rather this shape was intentionally produced or selected by the knappers, which stresses its importance.

The asymmetrical cores with large (preferential) removals (Group 2) may demonstrate that the shape of the cores has a new role: to help guide the removal of large flakes. The evidence at Rietputs 15 of organised cores, and in particular Group 2, demonstrates clearly that some hominids at some times may have had a relatively advanced concept of how to knap raw materials to produce larger flakes from natural or purposely shaped surfaces.

The cores with largest surface exploitation (Group 5) display the importance of the raw material shape selection, which should apply to the selection of material for the other groups as well. As previously stated these are not “organised” cores like the other groups. Rather, they demonstrate the careful consideration given to the original nodule selection.

While every effort was made to understand the flaking strategies of the core, determining the blank from its final morphology is often difficult or speculative in the absence of refits, particularly for artefacts with such abraded surfaces. Therefore data on individual core blank types were not recorded. This highlights the extreme importance of continued studies on early Acheulean core organisation strategies, as well as the need for experimental projects using the local raw materials to provide more in-depth understanding.

CHAPTER 7: CONCLUSIONS

7.1 CONCLUSIONS

The early Acheulean in the Vaal River basin has been investigated for over 100 years. However, for the future of archaeological investigation in the Vaal, emphasis on new provenience-controlled collection procedures and the obtainment of datable samples such as Rietputs 15 must be undertaken. Such has been the focus of this research.

The collection at Rietputs 15 is clearly Acheulean based on its handaxes, cleavers and generalized typology. With the 1.43 ±0.11 Ma date from Pit A and the overall dates of 1.8 to 1.35 Ma (Gibbon *et al.* 2009, Kuman and Gibbon, in press), there is little doubt other than to place the Rietputs 15 collection firmly in the Early Acheulean. Picks are also a prominent component of the Large Cutting Tools, which is another Early Acheulean trait. The early date for these deposits now demonstrates the Acheulean tool-bearing gravels of the Rietputs Formation are much earlier than previously thought, placing handaxe-making hominids in southern Africa as early as those in East Africa (Gibbon *et al.* 2009).

The organized flaking strategies we have interpreted in the Rietputs collection are significant as they have been identified on 20% of the large sample of cores. These patterns have become evident because of the large sample of provenience-controlled artefacts obtained from the massive amount of gravels processed in diamond mining operations. Previously, dates and localities could not be assigned to "dump" collections, and hence any "organised" cores may have been written off as out of place. Rietputs 15 proves that these cores come directly out of the Early Acheulean tool-bearing layer.

The organised flaking strategies have been placed in five groups of core type: asymmetrical discoid, asymmetrical with preferential removal, asymmetrical with preferential surface, elongated asymmetrical exploitation and largest surface exploitation. These groups represent a consistent intention by these early hominid knappers to produce relatively large removals from the largest surfaces, either through exploitation of existing faces of a core or through creation of those surfaces. The remainder of the core flaking strategies are assigned to more opportunistic, simple and centripetal flaking approaches.

The overall implications of the organised flaking strategies at Rietputs 15 are hugely important for the study of early Acheulean in South Africa and in general. These organised features could only be recognised with the careful provenience control and accurate dates. Because such a large sample was accessed from a gravel layer that was not as artefact rich as other sites in the area these patterns may have never emerged had this collection not taken place. Certainly new descriptive and techno-typological approaches to understanding core technology must be developed. Along with new absolute dates on the gravel sequences of the Vaal River basin, these will allow for an appreciation of early technology that will greatly enchance our past approaches to the study of cognitive evolution.

This work complements recent studies of the chaine opératoire involved in the earliest Stone Age. Even though the Oldowan industry is believed to be a basic “flake and core” industry, some research has suggested a higher understanding of the knapping process at that time (Delagnes and Roche 2005). This Early Acheulean collection from southernmost Africa, approximately a million years later in time, demonstrates the development of these early Oldowan cognitive abilities. The Rietputs’ cores show not only an understanding of how to maintain asymmetry and convexity in a core throughout the flaking sequence, but also the importance of raw material blank morphology in the decision-making process. Large surfaces are provided by the blocky and tabular forms in which the hornfels is found, as well as by the angular clast shapes of the Ventersdorp lava. However, the specific flaking strategies defined in this study are not driven only by the raw materials. Rather they are intelligent responses to the opportunities presented by those forms.

In addition to this analysis of core flaking approaches, the Rietputs 15 collection has provided a large sample of Early Acheulean handaxes, cleavers and picks from the earliest well-dated context in southern Africa. The bifaces demonstrate the importance of large flakes as blanks, but also the large degree of variability common to these diagnostic types during the Early Acheulean in general. The importance of future work on the Vaal gravels cannot be stressed enough as it can now be seen clearly that hominids in South Africa had an early idea of controlled, efficient, knapping for best results.

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