Specialist report on the Stone Age and other heritage resources at Kolomela, Postmasburg, Northern Cape

by

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Commissioned by

AFRICAN HERITAGE CONSULTANTS

AUGUST 2011

Glossary and acronyms

AIA *Archaeological Impact Assessment*

HIA *Heritage impact assessment*

Archaeological remains can be defined as any features or objects resulting from human activities, which have been deposited on or in the ground, reflecting past ways of life and are older than 100 years.

ESA Earlier Stone Age

MSA Middle Stone Age

LSA Later Stone Age

LIA Late Iron Age

"[**C**]**ultural significance** means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance" (1999: Act 25:2(vi))

"[**D**]**evelopment**" means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of a heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being" (1999: Act 25:2(viii))

Heritage. Heritage resources have lasting value in their own right and provide evidence of the origins of South African society. They are limited and non-renewable. The National Heritage Resources Act section 32, p. 55 defines these as *"An object or collection of objects, or a type of object or list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object".*

These include historical places, objects of archaeological, cultural or historical significance; objects to which oral traditions are attached and which are associated with living heritage; objects of scientific value, fossils, etc.

NHRA. National Heritage Resources Act.

Pre-disturbance survey means a survey to record a site as it exists, with all the topographical and other information that can be collected, without excavation or other disturbance of the site.

SAHRA South African Heritage Resources Agency.

The Act means the National Heritage Resources Act, 1999 (Act No. 25 of 1999).

Ya Years ago.

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FIGURES

1 Executive summary

Kumba Resources observe environmental guidelines whereby a reappraisal of heritage resources at their mining localities is generally required at five-year intervals. In 2005 a Phase 1 Archaeological Impact Assessment of the proposed mining areas for the Kolomela Mine on the farms Ploegfontein, Klipbankfontein, Welgevonden, Leeuwfontein, Wolhaarkop and Kapstevel, west of Postmasburg, Northern Cape (Map Reference 1:50 000 2822BD Beeshoek) was undertaken by David Morris, who assessed the Stone Age archaeology during a pre-disturbance survey at these localities.

African Heritage Consultants was accordingly appointed to conduct an investigation in order to provide an update review of the heritage resources at Kolomela and to compile a management plan of the heritage resources for Kolomela.

The following report comments on the current state of the Stone Age heritage occurrences at the Kolomela Mine and makes recommendations on the significance of the archaeological findings in accordance with the National Heritage Resources Act (NHRA) (Act No. 25 of 1999).

Morris (2005) established that within the eastern portion of the proposed mining area the landscape of the farms Ploegfontein, Klipbankfontein and Leeuwfontein is marked by numerous small pans within calcrete-capped plains on red soils. Whereas virtually all the pans contained lithic assemblages of various levels of significance, the plains had very low densities of artefacts with large tracts of land showing no visible archaeological remains.

On Welgevonden and Wolhaarkop very low densities of surface scatters of stone tools were recognised. While the Wolhaarkop locality was at that time not designated as a mining area it was considered to be of significant archaeological importance as a Later Stone Age (LSA) locality was identified against large boulders at a haematite outcrop on the hill.

- **Localities that feature small pans**

Following on this investigation Morris (2005) recommended that one of the small pan sites on Leeuwfontein should be sampled when a Phase Two archaeological investigation is undertaken. Whereas African Heritage Resources was appointed to merely provide a reappraisal of the archaeology and not a Phase Two archaeological mitigation, it was deemed necessary to establish the character, age and significance of the lithic assemblages within the pan areas. The methodology used was to place a one-meter frame on randomly-selected areas within a pan. The square was divided into four quadrants and the distribution of all stone tools and lithic debris within these was plotted.

The result of the survey on a selection of the pan sites indicates an average of 42 to 49 lithic elements per square meter. These include toolstone manuports, pebbles, cores, stone tool knapping debris, flakes and formal tools. The main raw materials used are banded ironstone and yellow jasper followed by Cryptocrystalline Silicas (CCS) such as opalines and also quartz. The mainly Middle Stone Age (MSA) and Later Stone Age (LSA) stone tool typologies demonstrate a palimpsest of utilisation of available resources with a predominant focus on pan localities. A very limited number of Earlier Stone Age (ESA) tool types, mainly made from dolerite, were identified. Following on the sampling of a number of pans it became evident that pans on the periphery of the drainage lines contain higher densities of stone tools and knapping debris.

Recommendation

The area is of medium to high significance. The survey confirmed low-density or isolated occurrences of stone tools on the plains and the periphery of the pans with a notably higher occurrence of lithics within the pan hollows. Pan localities in proximity of drainage lines. Should future mining or infrastructural development impact on the localities where pans occur a Phase 2 mitigation is proposed under a permit issued by the South African Heritage Resources Agency (SAHRA).

- **Wolhaarkop LSA site**

The LSA site at Wolhaarkop recommended for mitigation by Morris (2005) should a Phase 2 be required in the event of future mining activities, was reassessed during the current survey. This locality also contains some exceptional animal rubbing stones on the periphery of the haematite outcrops. The site is deemed to be of ideational and cultural significance in view of its setting within the physical and psychological landscape and the relationship between people and place (SAHRA1999:Act 25:3(3)(vi)).

Recommendation

The area is of high significance. It is consequently recommended that an undisturbed zone in a radius of two kilometres around this locality should be imposed.

- **A pre-colonial mine**

Pre-colonial open haematite mine workings consisting of a narrow trench with two stopes are also present on a hill on the Wolhaarkop farm. An estimated 3000 to 4000 tons of haematite ore have been removed before the mine was backfilled.

Recommendation

The area is of high significance. Current mining activities are some distance away, but if there should be any impact on the archaeological site, a Phase 2 mitigation under a permit issued by SAHRA is recommended.

- **Extension of the footprint**

The area is of relatively low significance. A survey was conducted on the section where the footprint of the mining plant is to be extended for a beneficiation process. Generally low densities of surface scatters of stone tools were recognised within the thin layer of calcrete capping.

Recommendation

- To ensure legal compliance the mine must commission a Phase 2 assessment on this area before applying for a destruction permit to SAHRA before any development or expansion of the mining activities in this area.

Also note the following:

- It should be kept in mind that archaeological deposits usually occur below ground level. Should archaeological artefacts or skeletal material be revealed in the area during construction activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the find(s) to take place (*cf*. NHRA (Act No. 25 of 1999), Section 36 (6)).

- A copy of this report will be lodged with SAHRA as stipulated by the National Heritage Resources Act (NHRA) (Act No. 25 of 1999), Section 38 (especially subsection 4).

2 Terms of reference

- An archaeological assessment was requested to review an earlier pre-disturbance survey (Morris 2005).This was according to environmental and heritage procedures practised by Kumba whereby a reappraisal of resources takes place at five-year intervals.

- The aim was to reassess previously identified archaeological resources and also to identify other potential archaeological and cultural heritage resources on which the proposed mining developments may impact.

- If any such heritage resources were identified these were to be assessed in relation to the potential impacts of the proposed development.

- To assign a comparative rating of significance to such heritage resources as prescribed in the National Heritage Resources Act (Act 25 of 1999).

- To recommend appropriate mitigation measures in accordance with the guidelines of the Act.

- To examine the extension of the mining footprint for a beneficiation process.

- To make recommendations as to the incorporation of the documented heritage resources into the proposed Kolomela Heritage Management Plan (see Küsel 2011).

3 Research methods and constraints

The properties that constitute the Kolomela mining project were visited during the week of 7 to 11 July. A mine representative accompanied the project team during the survey. All known as well as some potential areas for heritage resources were visited.

Movement and survey of some areas on the property were inhibited on account of active blasting and access restricted areas. These restrictions did not impact negatively on the heritage survey.

- A literature study of sources in the archaeology of the region was undertaken before the field investigation to gain an understanding of the archaeology and history of the broader region. The highlighted the complex Stone Age culture chronology and aided the assessment of the heritage fiends identified during the actual investigations.

- The Google Earth images provided a basis for the subsequent investigations. A detailed study of all possible features in relation to land-use patterns guided the subsequent field survey. The points were plotted with a hand-held Garmin Oregon 450 GPS. Interviews were also conducted with the Kolomela farm manager, Jacques Meyer. All identified localities and areas with structures were extensively surveyed on foot and documented.

- Pans previously identified with representative Stone Age concentrations were revisited to confirm their significance.

- All possible surface archaeological features and occurrences were investigated. In line with the nature of archaeological resources it is highly probable that mining and the provision of infrastructure activities are likely to reveal subsurface sites, human remains or areas of high-density stone tool distributions. In the event that any major archaeological feature is exposed all construction work should be stopped. A suitably qualified professional archaeologist should be contacted to undertake the specialist investigations.

4 The Stone Age sequence of the Northern Cape

4.1 Introduction: notes on the chronology of the southern African Stone Age

Archaeological traces in the form of mostly stone tools suggest a widespread presence for tool-producing Plio-Pleistocene hominins[1] in the Northern Cape. The archaeology of this region is dominated by millions of stone tools that derived from the very early occupations by stone tool-manufacturing hominins up to the intensive utilisation by hunter-gatherers until the recent past. The upland savannas of southern Africa are seen as a focal region of biological and cultural evolution during this period (Beaumont and Vogel 2006).

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[1] The term "hominin" instead of the customary term "hominid", acknowledge that African apes, including human ancestors, are closer to each other phylogenetically than any of them are to orang-utans (Mitchell 2002). The term hominid includes all the higher primates (chimps, gorillas, orang-utans, ancestral human types and ourselves), while hominin refers to those genera which evolved **after** the split with the chimps.

This important part of the prehistory of southern Africa, known as the Stone Age, is chronologically divided into the Earlier (ESA), Middle (MSA) and Later Stone Age (LSA). The ESA is characterized by the use of large stone cutting tools, in particular handaxes and cleavers. The MSA typologies represents greater specialization in the production of stone tools, and in particular flake, blade and scraper tools and also a more extended range of specialized, formal tools. During the LSA small, microlithic tools and a range of decorative items as well as rock art were produced. Ceramics were used and/or produced by hunters and Khoekhoe herders towards the terminal phases of the LSA.

In southern Africa a classificatory system of five successive Modes that describe **broad** patterns in stone tool manufacture is currently applied (Barham and Mitchell 2008:16) as well as the conventional Three-Age Stone Age division into the ESA, MSA and LSA (Deacon 1984a, 1984b) (for detail see Annexure 2. The method of using Modes avoids the association of particular tools with bounded periods of time. Processes of change were probably more gradual and continuous given that certain tool types are not restricted to a specific period so that developments within the various periods represent continuous processes of change. Any one assemblage can accordingly contain artefacts of various Modes.

Table 3 Archaeological context: sequence and definitions

Period	**Approximate dates**
Earlier Stone Age	more than 2 million years ago - 250 000/200 000 years ago
Middle Stone Age	200 000/250 000 years ago – 25 000 years ago to around the Last Glacial Maximum (LGM) in some regions
Later Stone Age (Includes Rock Art)	25 000 years ago - AD 200 and up to historic times in certain areas

4.2 Important Stone Age localities in the Northern Cape

The following framework provides an overview of major Northern Cape Stone Age sites in the general region of the survey area. The data are then applied to contextualise the archaeological occurrences identified within the footprint of the proposed development.

Wonderwerk Cave

One of the best-known sites in the region is the Wonderwerk Cave in the Kuruman Hills. The cave extends horizontally for 139 m and was formed by an ancient solution cavity in the dolomite formation (Beaumont 2004a:31). Excavations since the 1940s, which became more focussed as from

1976 to 1993, revealed a stratified series of deposits that accumulated up to a depth of about seven metres and are divided into nine Major Units (Beaumont and Vogel 2006). The application of a range of dating methods points to a complex cultural succession. The following cultural stages have been identified at Wonderwerk: an LSA at 1-12.5 kyr (kyr=thousand years ago), the MSA at around ~70 to >220 kyr ago, the Fauresmith to ~270-500 kyr ago and an ephemeral Acheulean at >0.78 myr BP (Beaumont and Vogel 2006). An interdisciplinary project initiated in 2004 aims at dating the ESA deposits in particular, using a range of radiometric techniques but will also focus on analysing the lithic, faunal and botanical remains recovered from these strata (Chazan et al 2008).

The lithic succession at Wonderwerk serves as a benchmark for the Stone Age sequence of the Northern Cape. It comprises an uppermost LSA sequence that contains Ceramic LSA, Wilton and Oakhurst (Humphreys and Thackeray 1983). Some of the cave deposit has been removed by guano diggers, which destroyed several of the important archaeological levels. The MSA levels that were still intact yielded blades and unifacial MSA points. The ESA sequence contains the usual large cutting tools (LCT's) and includes a Fauresmith assemblage with blades, large scrapers and radially-prepared cores. Whereas the paintings at Wonderwerk are in a poor state of preservation the region has some good engraving and painted sites (Morris 1988, 2002, 2003; Morris and Beaumont 2004).

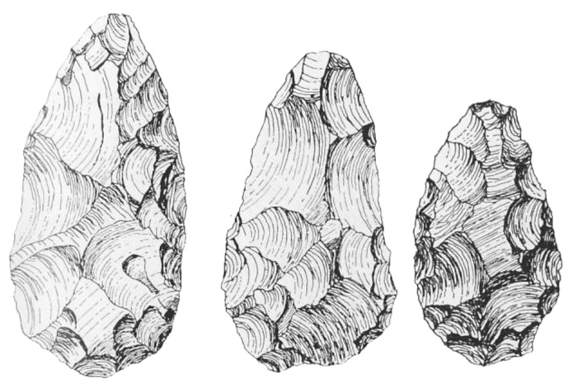
Shelter sites

The LSA of the Northern Cape is well researched (Humphreys and Thackeray 1983). Small rock shelters with occupations dating to the Holocene occur along the Ghaap Escarpment. A few of these have been excavated including Burchell's Shelter (Humphreys 1975) and Dikbosch I and II (Humphreys and Thackeray 1983). Burchell's Shelter has been occupied during historic times and travellers such as Burchell himself observed some of the Bushmen present within this region (Humphreys 1975:10, 16). Burchell, in describing their dress, wrote that they wore sandals and that their skin karosses were reddened with ochre (Humphreys 1975:16). It is evident from the archaeological investigations at Burchell's Shelter that only small groups occupied this locality and the artefacts and food remains demonstrate that they exploited a wide range of animals and collected plant foods, snakes and lizards, ostrich eggshell eggs and harvested termite eggs.

The shelters of Dikbosch I and the smaller locality of II are located on the edge of the Ghaap escarpment (Humphreys and Thackeray 1983). To the north of Dikbosch I is a stream bed below a waterfall that would have represented a good water source during prehistoric times. The occupational sequence at the bigger shelter shows a regular use of this locality throughout the major part of the Holocene. The preservation of organic materials is good and the artefactual remains demonstrate a range of hunting and gathering and also probably ritual activities. The excavations at Dikbosch II suggest intermittent and ephemeral occupations (Humphreys and Thackeray 1983:171).

The Kathu region

The Kathu sites contain significant ESA Acheulean and Fauresmith assemblages. Archaeological and palaeoenvironmental data from Kathu Pan and Kathu Townlands were used to reconstruct changes over time in the prehistoric environment (Beaumont 2004b:50). Associated faunal remains with some of the Acheulean assemblages include *Elephas recki recki*. These animals disappeared at sites in East Africa such as at Olorgesailie, Kenya, at around 600 000/800 000 years ago (Beaumont 2004b:51; McNabb 2004:656). This provides a relative date for the lithic assemblage. Biostratigraphy or faunal correlation is often used to date the southern African sites and gives some indication of the approximate age of associated assemblages.



The LCT's from this area often contain very fine handaxes with some superb examples produced on banded ironstone. In some of the Acheulean deposits, but also in MSA levels, lithics display a shiny silica skin. One particular site at the Kathu Townlands covers a large area and contains an estimated minimum of 10 billion flaked items. This is ascribed to the use of the high-grade bedrock jasper as a source for raw materials and this is supported by the high incidence of handaxe roughouts (Beaumont 2004b:52). The prepared core technique was used to produce the spectacular small handaxes, long blades, convergent flakes/points, scrapers found in Fauresmith collections. Some MSA tools were also recovered from the Kathu localities (Beaumont 2004b).

Pigment mining

Pigments such as ochre and specularite were widely used. The specularite mines at Tsantsabane/Blinkklipkop and Doornfontein 1 near Postmasburg were rich and well-known ore sources that were quarried extensively over a long period of time (Beaumont and Thackeray 1981:1-2; Beaumont and Morris 1990:65-74; Mitchell 2002:256-7; Morris 2004). Dunn (1931:110) was told that 'it was from here that the Bushmen and other natives for hundreds of miles obtained their supplies of specular iron ore, which becomes red when burnt'. The pigment was widely bartered and exchanged for goods such as iron knives, assegais, axes, tobacco, copper and iron and copper ornaments and beads (Campbell 1822:Vol II; Burchell 1967; Arbousset and Daumas 1968). Investigations at Blinkklipkop established a date of AD 800 for the utilization of this particular rich source (Thackeray et al 1983; Beaumont and Morris 1990).

The LSA at the pigment mines

The use of earth pigments, and in particular ochre and specular haematite, is universal (Watts 2002:1). Pigments, but moreover the exceptional pieces of engraved and ground incised pieces of ochre from MSA contexts at sites such as Wonderwerk, attest to the time-depth of such practices (Mitchell 2002:99). Specular haematite was extensively mined by at least 40 000 BP at Ngwenya, Swaziland (Nkambula 2011). Quarrying of ore bodies often destroy earlier evidence for the utilisation of the resource. The investigations at Tsantsabane/Blinkklipkop near Postmasburg in the Northern Cape (Thackeray et al 1983; Beaumont and Morris 1990) established a date of AD 800 for the utilization of this particular rich source. The mainly late Holocene lithic sequences at the mining localities are characterised by informal tool types with low frequencies of formal tools. Some of these were most likely to have been used in the mining and processing of the pigments. Pottery and items of European origin have also been recovered (Morris 1990:67-70).

5 The Stone Age archaeology of Kolomela

5.1 Notes on the topography and geology

Only aspects of the geology that are pertinent to the archaeological assemblages are referred to. The south-eastern part of the Kolomela Mine property, which comprises around 50 000 ha, consists of mainly calcrete-capped plains on red soils. Very numerous small shallow pans, also known as dolines, of 100 to 200 m in diameter with a couple of larger pans, occur over most of this area. A doline is an enclosed depression that forms in mostly carbonate rock types. The two main types of dolines are identified on the mechanism of their formation, namely a dewatering-type and surface saturation-type dolines. A third kind, known as an incompletely developed sinkhole, has a similar surface appearance as the other two forms but is caused by the erosion of subsurface materials (www.geoscience.org.za).In the Northern Cape Province, carbonate rocks mainly comprise the Campbell Rand Subgroup (Ghaap Group, Transvaal Supergroup), with an age of ~ 2600–2400 Ma.

Outcrops of the Ongeluk Formation that forms part of the Griqualand West Sequence contain amygdaloidal andesitic lavas interbedded with tuff, agglomerate, chert and jasper. Outcrops of the Gamagara Formation in the basin between Postmasburg and Sishen contain conglomerate, quartzite, shale and the ferruginous Blinkklip breccias. The preferred stonetool material used in the production of lithic assemblages is mostly of igneous or metamorphic origin. Blocks and nodules of suitable raw materials can be sourced along outcrops and water courses where they have been dumped through water action.

5.2 The impact of the proposed mining activities and sub-surface Stone Age occurrences

During the survey lithic occurrences of significance were found to be mainly localised. However, there is always the possibility that sub-surface archaeological sites may be revealed through the proposed mining activities. Should archaeological artefacts or skeletal material be found in the area during construction activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the find(s) to take place (*cf*. NHRA (Act No. 25 of 1999), Section 36 (6)).

5.2.1 The pans on Leeuwfontein

During the foot survey the patterning observance by Morris (2005) of a generally dispersed scatter of stone tools across the landscape, but with a major focus on the utilisation of stonetool materials and also the plant and water resources provided by the numerous small pans settings, was substantiated.

Fig. 1 View of a pan sampled at Leeuwfontein

Methodology used in sampling the lithics

From burrowing activities within the pans it was evident that the soil horizons are very shallow (Glenrosa soil form). The lithics occur dispersed within the pans. Investigation of the distribution pattern established that the stone tools lie mostly on the surface. Applying Shovel Test Pits for sampling was therefore not feasible. Both depositional and post-depositional processes resulted in a relatively random distribution of artefactual material with no apparent clustering in activity areas. In order to obtain representative samples a random selection process was used. A one-meter frame, sub-divided into quadrants, was placed over randomly selected areas at the pan at Leeuwfontein (28° 22' 687; 22° 59' 851) identified by Morris (2005) for possible further investigations. This pan exhibited some of the greatest densities of artefacts and debris and was therefore selected for a statistical sampling of lithic scatters. All lithics from each unit within the grid were subsequently analysed and then returned to their original position on the surface. The materials collected through this methodology were processed through applying descriptive and analytical criteria. An inventory of cultural material was drawn up (see Annexure 1).

Fig. 2 Sampling of the lithics at Leeuwfontein

Surface assessment at other pan sites

Surface identification of the highly dispersed lithics at was also undertaken at a number of pans. These delivered mostly diagnostic tool types of the MSA tools with a thin overlay of LSA tool types ESA Large Cutting Tools were not common finds during the current survey and only a few examples were identified.

Discussion

Altogether the Kolomela assemblages at the pan localities reflect relatively short visits over time by small groups of people. Hunter-gatherers view land as an integral part of their identity. Each group has a defined territory with a collection of natural resources on which they depends for survival (Marshall 1976; Barnard 1992). Ownership implies access to the resources of this area, an inalienable right which is acquired by non-exclusive inheritance and utilization. The subsistence strategy inherent in the planning of hunting and gathering trips is to limit the duration and the distances to be covered. Primary territories would have included a permanent or semi-permanent waterhole (Smith 1999), such as the pans, springs and annual watercourses at Kolomela, along with other resources, in particularly plant foods.

Mobile communities require a highly-developed landscape sense to mentally map and utilize the range of available resources. All nomadic groups move their camp sites frequently during the year. Barnard (2011:63) argues that hunter-gatherers are not nomadic but transhumant as they do not move randomly across a landscape. While there is variation within ecological zones in the Northern Cape the environment does not have very marked differential resource distribution patterns. Whereas groups in this region of the Northern Cape certainly moved across the landscape to take advantage of seasonally-available staple plant foods the subsistence patterns of the prehistoric hunter-gatherers and Bushmen do not exhibit the distinct seasonality patterns as in other regions within southern Africa. Land-use patterns in the Northern Cape seemed to have been more generalised and flexible (Humphreys and Thackeray 1983:27).

The general availability of water in the form of springs and seasonal small pans also does not require a marked seasonal mobility pattern. The terms that Bushmen used for water distinguish between rivers, springs, waterholes, excavated water and etcetera. Such terms appear ubiquitous in the original place names, demonstrating an emphasis on the reliability of water resources. In the research area the term *//gami,* for strong reliable springs, was commonly used as part of indigenous place names with only two instances where places with weak springs were known as */aus* (Humphreys and Thackeray 1983:27). This clearly demonstrates that good sources of water were generally available.

Pans constitute primary sources of water within the semi-arid environment present at Kolomela. In the past such water sources not only formed the distinct foci of all animal life, but also that of the hunter (Silberbauer 1964). The occurrence of ESA, MSA and LSA lithics within the pan areas attest to the presence of earlier as well as more recent earlier populations, spanning a period of utilisation over many hundred thousands of years. All pan localities exhibit evidence of the knapping of stone tools, which suggest groups camping nearby for a couple of days while exploiting the local resources. As we have so few eyewitness accounts of the Bushmen of this region it is mostly the archaeological data that inform on past lifeways and adaptations to a specific region (Smith 1999:256).

The Kolomela collection represents a mix of stone tools from various periods. An ephemeral ESA is represented by some large cutting tools (LCT's), but the main component consists of MSA and LSA cores, flakes, blades, bladelets, formal tool types and waste from stone tool knapping and other lithic reduction processes. Flakes, blades and bladelets are the main products of any stone reduction process.

A range of locally-available raw materials was utilized in the production of the lithics. The collection is dominated by local cryptocrystalline silica rock types being fine-grained and eminently suitable for knapping. Jaspers, (mostly yellow, but also the red form) and banded ironstone are particularly abundant and used for the bulk of the lithics followed by cryptocrystalline silicas (CCS), quartz, and low percentages of other materials such as hornfels.

Local rock types were generally used at most Stone Age localities with low numbers of tools occasionally made on rocks imported to the region or manufactured at other localities and then carried to a camp site (Beaumont 2004a, 2004b). On account of the density of good quality raw materials available at the Kolomela localities extensive knapping activities took place over time as evidenced by relatively high frequencies of cores (see figures 3 and 4) and flakes (see figure 5).

Fig. 3 Core types from Pan 1 on Leeuwfontein

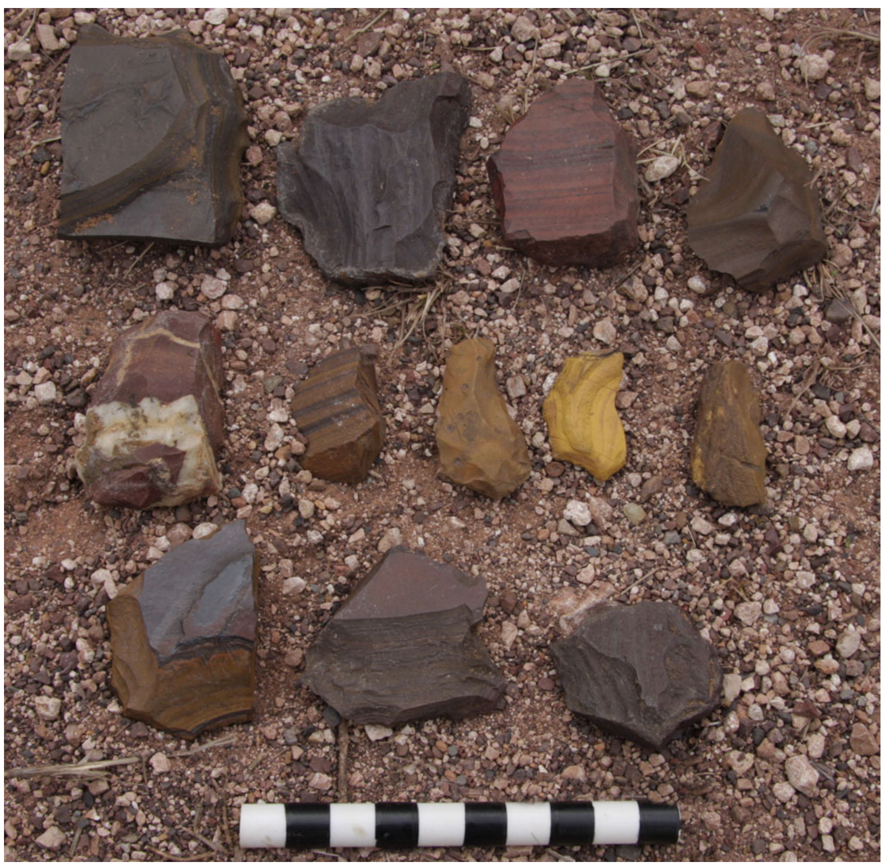


Fig. 4 More core types from Pan 1 on Leeuwfontein

Fig. 5 Some of the flake types from Pan 1 on Leeuwfontein

Scrapers represent the major formal tool class, and then predominantly side-scrapers. The scrapers fall in all the formal size categories, that is, large, medium-large, medium and lower numbers of small scrapers (less than 20 mm) (see figure 6).The morphology of scrapers can also change through use, and the very small size of some scrapers can result from attrition through use or resharpening (Andrefsky 1998:37). It is therefore not in all the examples possible to assign firm associations of the lithics with specific Stone Age periods. Due to the nature of the collections, which are mainly a mix of MSA and LSA tool types, tools were merely classified according to the time frame, raw material type and artefact morphology with no detailed formal analysis being undertaken.

Fig. 6 Scraper types from Pan 1 on Leeuwfontein (2 mm squares)

Debitage from stone tool production accounts for the largest proportion of the lithics. The presence of several formal tool types, and in particular the range of scrapers, but also some awls and borers (see figure 7), suggests that other subsistence processes such as woodworking and possibly the working of skins took place at the pans. All the lithic artefacts would also have featured as subsistence tools and in activities such as food processing. Both ethnographic and archaeological data demonstrate that individual stone tools may be versatile and multi-functional and/or used expediently (Silberbauer 1996; Andrefsky 1998).

Fig. 7 Awls from Pan 1 on Leeuwfontein

The following figures illustrate some of the surface lithics sampled at some of the other pans on Leeuwfontein.

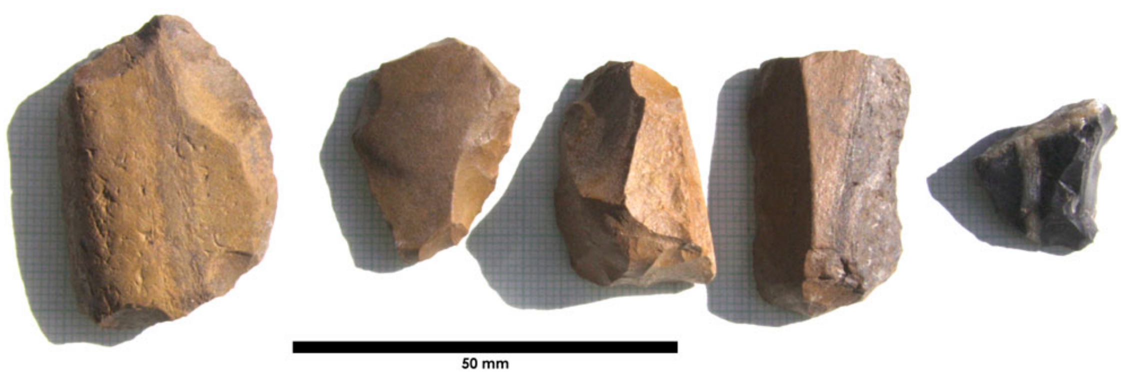


Fig. 8 Scrapers from Pan 2 on Leeuwfontein

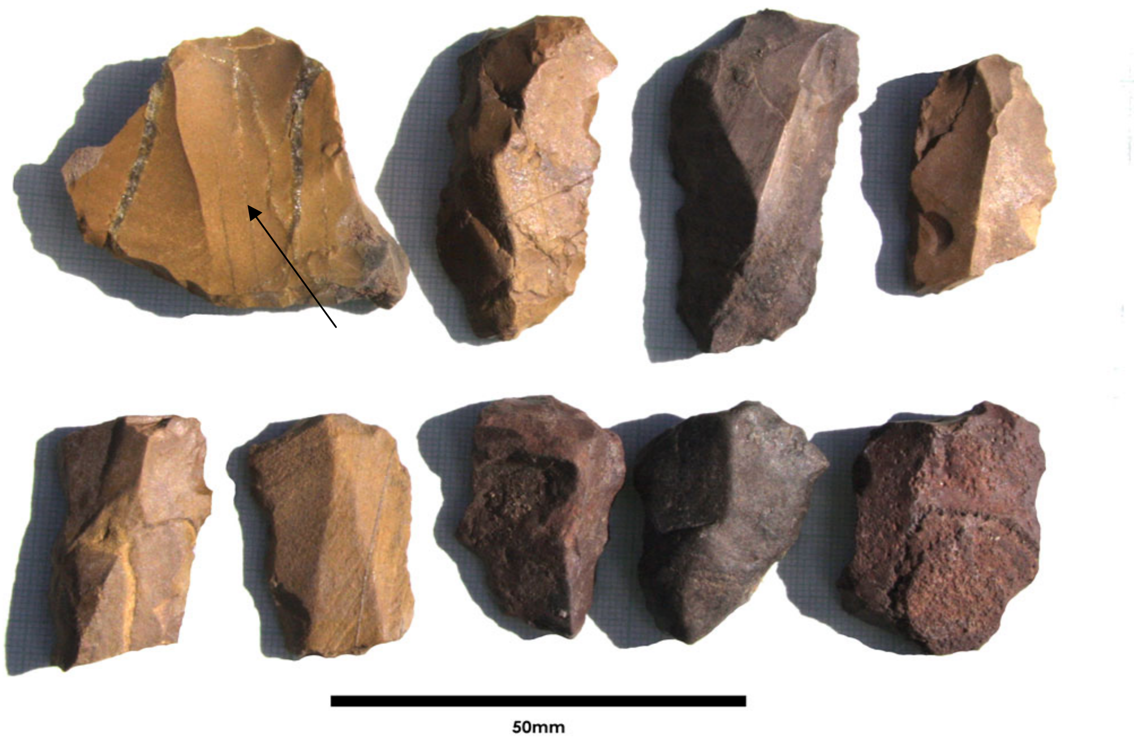


Fig. 9 MSA core with triangular flake removal (indicated by arrow), blades and convergent flakes from Pan 2 on Leeuwfontein

Fig. 10 Bladelets from Pan 2 on Leeuwfontein

Ceramics at Pan 2 at Leeuwfontein

A number of undecorated ceramic fragments were document at Pan 2 on Leeuwfontein. The ceramics are undiagnostic and cannot be assigned to a specific group. However, within the same area an iron implement was also recovered. These artefacts mostly likely reflect the presence of African groups on the landscape. This is not surprising, particularly in view of the precolonial mine identified at Wolhaarkop.

Fig. 11 Undecorated ceramic fragments and iron implement (right at bottom of photograph) from Pan 2 on Leeuwfontein

Pan 5 on Leeuwfontein

This pan lies at some distance from the others discussed above. On the Google maps it appeared to be a relatively prominent feature. However, it was not accessible from the main survey area and special arrangements were made with the farm manager, Jacques Meyer, to visit this locality. It is situated close to a gully where large chunks of toolstone, mainly jaspers and banded ironstone, were transported and deposited through water action. The availability of good resources of raw material probably accounts for the fact that the stone tools in the pan are generally large. This locality is also the only one identified during the survey where the surface collection is dominated by ESA tool types.

Fig. 12 View of Pan 5 on Leeuwfontein

Fig. 13 Lithics from Pan 5 on Leeuwfontein: The ESA tools in the top row are respectively a proto-handaxe and a chopper. The others lithics are informal cores and two smaller radial cores

Fig. 14 Blades, broken blades and the distal section of a triangular flake from Pan 5 on Leeuwfontein

The ESA Acheulean large cutting tools at Kolomela

The large cutting tools identified at Kolomela evidently form part of Acheulean assemblages. In the Northern Cape ESA assemblages with large cutting tools (LCT's) tend to occur as lag deposits on the margins of seasonal rivers, semi-permanent water holes or pans. Such assemblages commonly represent the accumulated remains of numerous reoccupations over possibly many thousands of years. The particular localities from where most of the LCT's in the Kolomela collection originate reflects the correlation of Acheulean sites with sources of water and an environment that could provide animal and plant foods (Deacon 1988:643-647; Mason 1988:626-30; McNabb et al 2004:656).

Figure 15 illustrates a finely-made handaxe on a green quartzite. The distal point is missing. This locality does not fall within the footprint of the survey, but was visited to investigate some stone-walled structures identified from the Google Maps.

Fig. 15 Handaxe from dam site. Note damage to the distal point

The MSA at Kolomela

During the heritage assessment under review a representative collection of MSA artefacts has been documented. The South African MSA is a broadly-defined time period of particular relevance with research focus on the technology, cognition and social development of humans. The human groups that utilized the environment at Kolomela and who produced the MSA lithic sequence fall within the range of modern humans. The South African MSA archaeology, by being associated with the earliest known remains of anatomically modern people and also cultural modernity, represents a unique window on the physical, cultural and social developments within this time frame (Thackeray 1992; Deacon and Wurz 2001; Wadley 2001; Willoughby 2008).

Southern African MSA assemblages show great diversity resulting from factors such as the environment, resource availability and choices made in the selection of raw materials as well as technologies used in the production of artefacts. MSA assemblages also exhibit much variability in raw material usage and artefact morphology, with often low frequencies of formally-retouched artefact types. Within the long span of the MSA, older and younger assemblages are apparent. The earliest MSA assemblages date to around 250/200 000 years ago, but are more widespread from the Last Interglacial (OIS 5) (Mitchell 2002:80).

The Kolomela collection is not large enough for the MSA tools to be assigned to particularly phases within the MSA. The range of tool types, the diversity of raw materials used as well as the presence of formal tools types reflect various instances of site utilisation over a very long period of time. As the lithics were surface finds it is probably that sub-surface assemblages may be present. The pan sites should accordingly be considered as archaeological-sensitive areas.

During the MSA cores were prepared in order to produce pre-determined shaped blanks which were subsequently used to manufacture different tool types. The prepared core/Levallois core technique was used during the MSA to produce triangular flake and blade blanks. The size of raw materials selected for a core influences the kind or reduction technology used (Andrefsky 2005:151-5). Levallois core reduction requires relatively large objective pieces, and the technique is not suitable for the generally small nodules of cryptocrystalline materials that were preferred rock types during the LSA. Levallois reduction technology is based on the preparation of a core by systematic shaping to produce a conical or convex shape with a continuous striking platform around most of the perimeter of the selected nodule. Multiple flakes can be systematically removed from the prepared platform, with the conical objective piece maintaining its shape so that minimal repreparation is required before subsequent removals (Andrefsky 2005:148-9).

The surface collection around the pans delivered some prepared cores characteristic of MSA technologies. Some of the flake and blade blanks exhibit faceted striking platforms derived from prepared cores as discussed above. The production of flake blanks >30 mm was likely not only for expedient use, but also to fashion other formal tools, and in particular scrapers (Van der Ryst 2006). Some of the flake blanks have been utilized, demonstrating their use as expedient tools.

Fig. 16 Examples of MSA tools from the plains

Fig. 17 More examples of MSA tools from the plains

The LSA at Kolomela

The typology of the LSA conforms to most assemblages from this period. The relative low numbers of lithics identified during the sampling of the pan assemblages are statistically insignificant and cannot be used to make inferences on any particular LSA industry. Blanks such as flakes were used to produce a representative range of formal stone tools. Formal tool types are represented by a range of scraper forms, backed bladelets with retouch, borers and spokeshaves.

Significance assessment and recommendation

The pan localities are assigned to be of **medium to high** significance. The survey confirmed low-density of stone tools on the periphery of the pans with a notably higher occurrence of lithics on the pan surfaces. Should future mining or infrastructural development impact on the localities where pans occur a Phase 2 mitigation is proposed under a permit issued by the South African Heritage Resources Agency (SAHRA).

5.2.2 Other Stone Age occurrences at Kolomela

Apart from the pans, the survey determined that stone artefacts were not prolific within the general area of the proposed development and mainly isolated specimens or dispersed clusters were observed to be present. This reflects the foraging and hunting activities of groups of people and individuals moving across a landscape over long periods of time.

Only one handaxe has been collected on the farm Wolhaarkop that may originate from the Fauresmith industry. Handaxes/bifaces are classified as formal tools because they have been shaped or transformed into a specific form and given a cutting edge through secondary retouch (i.e. by removing small flakes). The Fauresmith is transitory between the ESA and MSA, or form part of a fully developed MSA (Mitchell 2002). A lack of excavated and well-documented open-air sites from the interior with regional representative stratigraphic sequences inhibits the identification of regional patterns within the various phases of the Stone Age.

Significance assessment and recommendation

The survey confirmed low-density or isolated occurrences of stone tools on the plains. The areas are of **low** significance. No mitigation is required.

5.2.3 Wolhaarkop

An LSA site (28° 20’ 874”; 22° 252’ 111”) on the south-eastern side of the haematite outcrop is situated above an annual stream. This sheltered area found by Morris (2005) was relocated through the presence of LSA microliths in association with worn fragments of ostrich eggshell. Stone tools from both the MSA and LSA occur in the vicinity of the outcrop, but LSA types dominate. Tool knapping is particularly evident in the north-western portion where the level surface areas are scattered with stonetool materials, cores, flakes and waste from stone tool reduction technologies.

Fig. 18 The LSA locality with animal rubbing stones at Wolhaarkop

Fig. 19 Surface finds of LSA cores and scrapers at the Wolhaarkop haematite outcrop

5.2.4 Animal rubbing stones at Wolhaarkop

At the above site on Wolhaarkop some of the large haematite boulders on the periphery of the outcrop exhibit large polished areas that resulted from animals rubbing themselves against the crystalline haematite formation. Above the stream another large boulder shows similar smoothened areas. Some of the polished areas are at a height of 2 meters above the current ground level, which is indicative of the size of the animals that utilized the stones in the past.

Mega herbivores such as rhino and elephant, but also warthogs, use favoured localities after a mud wallow as a rubbing stone to remove ectoparasites (Smithers 1983). Rhinoceroses, and in particular the square-lipped *Ceratotherium simum*, are marked territorial animals whose territorial boundaries often include topographical features such as streams and the crests of ridges (Smithers 1983). As early as 1779 Wikar, while travelling along the Orange River, remarked on the fact that the rhinoceros not only keeps to a fixed sleeping place, and a fixed place for his midden, but that a distinct locality, and then specific boulders only, are used as rubbing stones (Skead 1976). The seemingly idiosyncratic manner, in which only specific features within an area, usually near water, are selected with other nearby boulders left untouched, seems to be characteristic of rhinoceros behaviour. During the survey it was observed that cattle still frequent this locality and probably use the rubbing stones to rid themselves from ectoparasites.

Such rubbing stones are sometimes a feature at Stone Age localities and may contain engravings or rock paintings and then often of rhinoceroses (Ouzman 2001). These sites are usually situated near a water source. Stone Age research has demonstrated the importance of water to prehistoric communities not only as a subsistence resource, but also as a spiritual resource (Van der Ryst et al 2003). The use of a specific locale by both humans and animals over time also strengthen the continuous process of socializing the landscape (Taçon et al. 1997). Among the Bushmen certain animals, such as rhinoceroses, feature in rain-control ceremonies and other rituals (Ouzman 1996, 2001, 2002). The layered use of localities by both animals and humans would have created a sense of place and added to the energy of locales such as Wolhaarkop.

Fig. 20 One of the animal rubbing stones at Wolhaarkop

Fig. 21 Detail of a rubbing stone at Wolhaarkop

Fig. 22 Detail of a rubbing stone at Wolhaarkop

Significance assessment and recommendation

High significance is assigned to this locality. The Wolhaarkop LSA site with the rubbing stones is deemed to be of ideational and cultural significance in view of its setting within the physical and psychological landscape and the relationship between people and place (SAHRA1999:Act 25:3(3)(vi)).It is consequently recommended that an undisturbed zone in a radius of two kilometres around this locality should be imposed.

5.2.5 A pre-historical mine Wolhaarkop (28°22'37.43"S 22°52'46.12"E)

A historic open-mine working is present within the prospecting area of the Wolhaarkop open-cast pit. The area surrounding the workings has been heavily prospected during the current mining activities. The mine working has been identified as pre-historical on the absence of any mechanical drilling or blasting marks and also because it has been back-filled. The open-mine workings of haematite consist of a narrow trench with two stopes on the highest section. Ancient open mining technology resulted in a narrow deep trench and was suited to rocks that dip steeply or are vertical (Hammer et al 2000:51). The mine workings drain towards the east. A drainage feature found at most mines from this period as it prevented flooding. Ancient mining activities were usually scheduled for the winter months because of a relatively lower water table during the drier months (Hammer et al 2000:52).

From the circumference and depth of the workings it has been estimated that 3000 to 4000 tons of haematite ore could have been removed. There seemed to have been tunnels but this could not be positively determined as the excavated area had been backfilled as was customary for most prehistoric mines. This was done for safety (Hammer et al 2000) but also because of beliefs and rituals about the ore extraction process (Küsel 1979).

The ancient miners had to evaluate the potential and grade of the ore bodies in view of the technologies used to obtain a successful smelt. The ore obtained was usually broken down to remove impurities and to facilitate transport. Hammer et al (2000:52) argue that '[m]iners had to have a conceptual understanding of the reef in order to decide how to extract it, as well as the tools and practical skills necessary to do so. Further, the numerous physical and mechanical obstacles necessitated more social cooperation and a series of technological decisions ...'. Some of the ore chunks discarded on the surface outside the mine area show bands of specularite.

Morris (2005:4) found no specularite workings during his survey. However, oral information provided by the previous owner of Wolhaarkop indicated that two small outcrops of specularite have been worked by some groups during the twentieth century.

Fig. 23 Pre-colonial mine at Wolhaarkop

Significance assessment and recommendation

A high significance is assigned to this feature. The pre-historical mine will be directly impacted upon by the open-cast mining. A Phase 2 mitigation under a permit issued by SAHRA is recommended. The

Phase 2 assessment needs to confirm the nature and extent of the ancient mining activities and at least partially re-open the mine to investigate the mining practises used.

5.2.6 The Stone Age at the future plant area

A survey was conducted on the section where the footprint of the mining plant is to be extended for a beneficiation process. Generally low densities of surface scatters of stone tools were recognised within the thin layer of calcrete capping. The assemblage is dominated by MSA tool types such as blades and convergent flakes. The presence of cores indicates *in situ* manufacturing. Only a few examples of LSA lithics were documented.

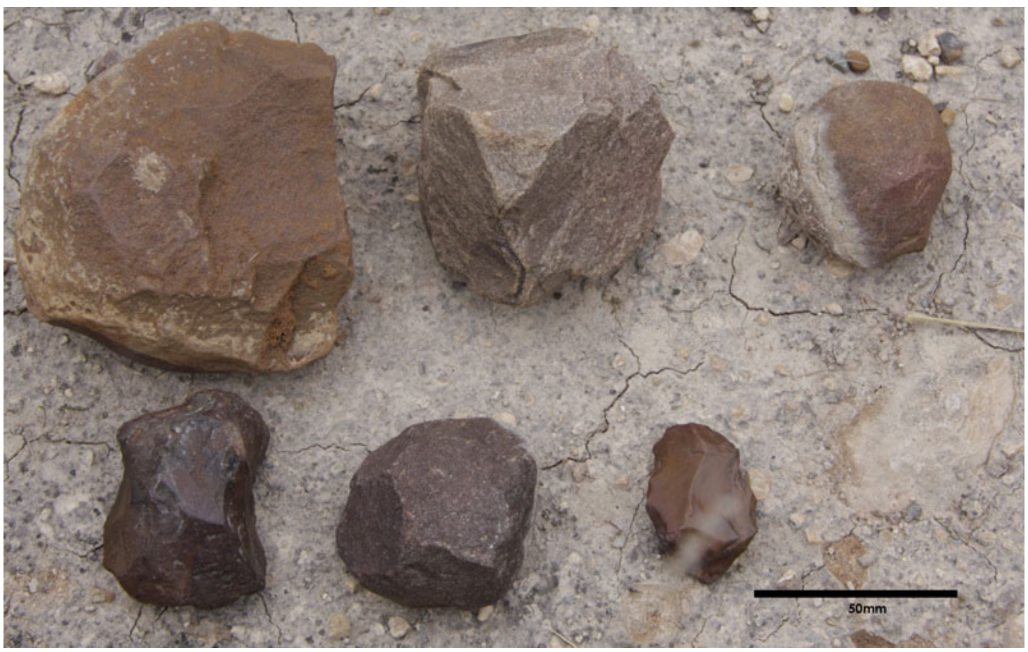


Fig. 24 Core types from the footprint area of the proposed beneficiation plant

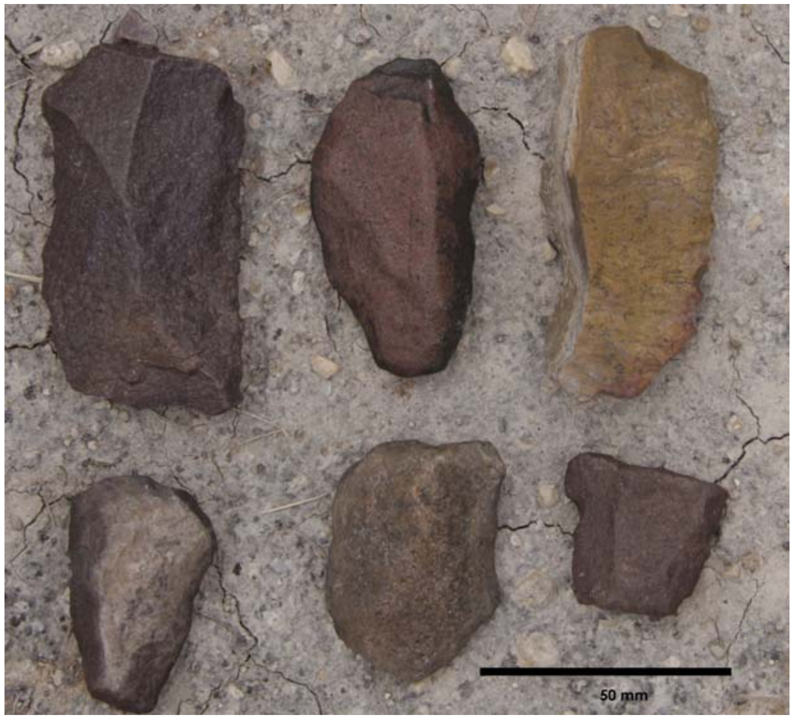


Fig. 25 Blade types, a convergent flake and a broken blade from the footprint area of the proposed beneficiation plant

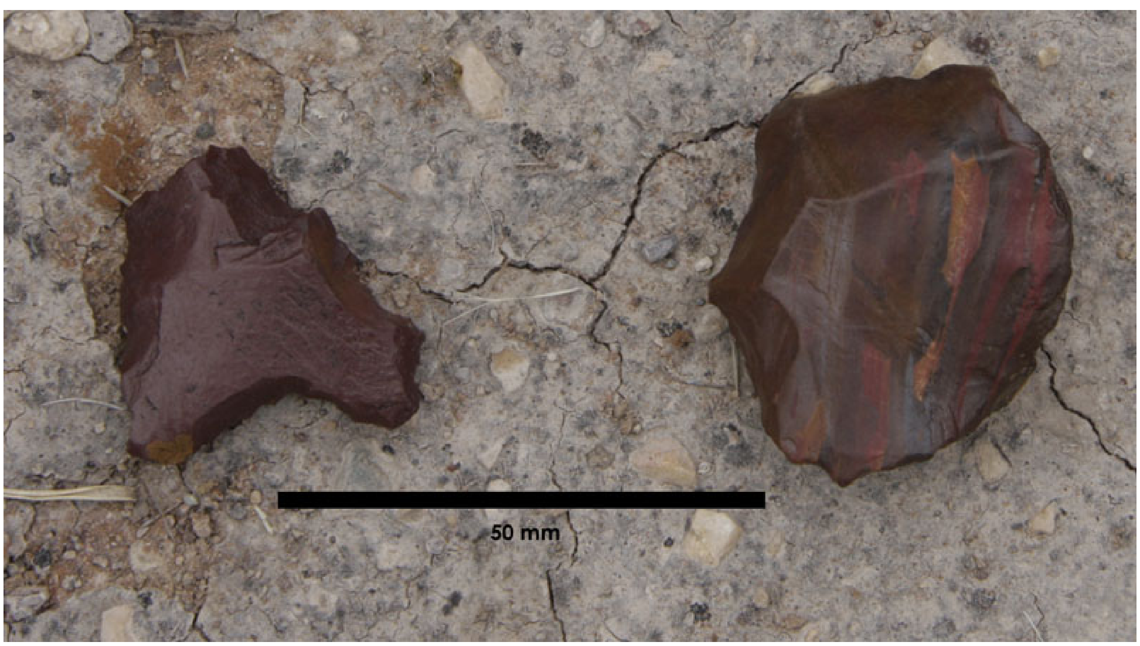


Fig. 26 A notched and a side scraper from the footprint area of the proposed beneficiation plant

Significance assessment and recommendations

The area is of relatively low significance. To ensure legal compliance the mine must commission a Phase 2 assessment on this area as part of the destruction permit to be issued by SAHRA prior to the commencement of any development or expansion of the mining activities.

6. Summary of recommendations

LOCALITY		COORDINATES	DESCRIPTION	SIGNIFICANCE	MITIGATION
Pan sites	Leeuwfontein	S28 22 40.9 E22 59 50.9	Numerous small shallow pans, of 100 to 200 m in diameter, with a couple of larger pans.	Medium - High	Should future mining or infrastructural development impact on the localities where pans occur, a suitably qualified archaeologist should be contracted to undertake a Phase 2 survey that will include representative sampling of the assemblages.
Other Stone Age localities	All open areas with isolated lithics	S28 25 47.6 E22 57 38.5	Surface scatters on the plains	Low - Medium	No mitigation. Should any sub-surface archaeological remains become exposed during future mining activities an archaeologist should be contracted to comment on the significance of the finds.
LSA site Rubbing stones	Wolhaarkop	S28 20 52.4 E22 52 06.6	A small haematite outcrop with an open LSA living site and surface knapping debris. A number of the large hematite boulders served as animal rubbing stones.	High	The area is of high ideational and cultural significance. It is consequently recommended that an undisturbed zone in a radius of five kilometres around this locality should be imposed.
Pre-colonial mine	Wolhaarkop	S28 22 37.4 E22 52 46.1	On open-air mine where haematite has been mined	High	A high significance is assigned to this feature. The pre-colonial mine will be directly impacted upon by the open-cast mining. A Phase 2 mitigation under a permit issued by SAHRA is recommended. The Phase 2 assessment needs to confirm the nature and extent of the ancient mining activities and at least partially re-open the mine to investigate the mining practises used.prio
Future plant area	Leeuwfontein	S28°22'54.00" E 22°57'30.10"	Beneficiation process	Low - Medium	The area is of relatively low significance. To ensure legal compliance the mine must commission a Phase 2 assessment on this area in order to apply for a destruction permit to be issued by SAHRA prior to the commencement of

					the expansion of mining activities.

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ANNEXURE 1 Inventory of stone tool analyses from sampled squares

Sample 1

Sample 1 Quadrant A					
Tool type	**Banded ironstone**	**Jasper**	**CCS**	**Haematite**	**TOTAL**
Cores					
Pebbles		3		1	4
Flakes	6				6
Scraper Large					
Scraper Medium		1			1
Scraper small					
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL	6	4		1	11

Sample 1 Quadrant B					
Tool type	**Banded ironstone**	**Jasper**	**CCS**	**Haematite**	**TOTAL**
Cores	1				1
Pebbles	4	3			7
Flakes	7		2		9
Scraper Large					
Scraper Medium	1				1
Scraper small					
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL	13	3	2		18

Sample 1 Quadrant C					
Tool type	Banded ironstone	Jasper	CCS	Dolerite	TOTAL
Cores					
Pebbles					
Flakes		1	1	4	6
Scraper Large					
Scraper Medium					
Scraper small					
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL		1	1	4	6

Sample 1 Quadrant D					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores					
Pebbles	8				8
Flakes	2				2
Scraper Large					
Scraper Medium					
Scraper small					
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL	10				10

SAMPLE 1 TOTAL 45

Sample 2

Sample 2 Quadrant A					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores			1		1
Pebbles	2	1			3
Flakes	8				8
Scraper Large					
Scraper Medium	1				1
Scraper small					
Blade	1				1
Bladelet		2			2
MSA convergent					
Awl					
Borer					
TOTAL	12	3	1		16

Sample 2 Quadrant B					
Tool type	Banded ironstone	Jasper	CCS	Haematite	TOTAL
Cores					
Pebbles					
Flakes	9			1	10
Scraper Large					
Scraper Medium		2			2
Scraper small					
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL	9	2		1	12

Sample 2 Quadrant C					
Tool type	Banded ironstone	Jasper	CCS	Dolerite	TOTAL
Cores					
Pebbles		2			2
Flakes	7	3			
Scraper Large					
Scraper Medium					
Scraper Small		1	1		
Blade					
Bladelet					
MSA convergent					
Awl					
Borer					
TOTAL	7	6	1		14

Sample 2 Quadrant D					
Tool type	Banded ironstone	Jasper	CCS	Dolerite	TOTAL
Cores					
Pebbles		1			1
Flakes	3	1			4
Scraper Large	1				1
Scraper Medium					
Scraper small					
Blade					
Bladelet					
MSA unifacial	1				1
Awl					
Borer					
TOTAL	5	2			7

SAMPLE 2 TOTAL 49

Sample 3

Sample 3 Quadrant A					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores					
Chunks	3				3
Flakes	3	3			6
Scraper Large					
Scraper Medium	1				1
Scraper small		1			1
Blade					
Bladelet		1	1		2
MSA convergent					
Awl					
Borer					
TOTAL	7	5	1		13

Sample 3 Quadrant B					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores					
Chunks	3	1			
Chips		3			
Flakes					
Scraper Large					
Scraper Medium	1				
Scraper small					
Blade					
Bladelet	1				
MSA convergent					
Awl					
Borer					
TOTAL	5	4			9

Sample 3 Quadrant C					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores			2		2
Chunks	7				7
Chips	1	1			2
Flakes					
Scraper Large					
Scraper Medium	1				1
Scraper small					
Blade	1				1
Backed bladelet			1		1
Broken bladelet			1		1
MSA convergent					
Awl					
Borer					
TOTAL	10	1	4		15

Sample 3 Quadrant D					
Tool type	Banded ironstone	Jasper	CCS		TOTAL
Cores			1		1
Chunks	1		1		2
Chips					
Flakes					
Scraper Large					
Scraper Medium	1				1
Scraper small					
Blade					
Backed bladelet					
Broken bladelet					
MSA convergent					
Awl					
Borer					
Spokeshave	1				1
TOTAL	3		2		5

SAMPLE 3 TOTAL 42

ANNEXURE 2

The South African Stone Age

The Three-Age system

The Three-Age system created in 1929 by Goodwin and Van Riet Lowe introduced time frameworks for the Stone Age archaeology of southern Africa at a stage when there were no chronometric dating methods available. They constructed a three-age division to describe variability and successive phases of stone tool use. The typology developed to construct these culture-historical frameworks was based on the formal attributes of the stone tools present in assemblages that were apparently from different, time-successive periods. *Fossiles directeurs* (Dunnell 1986) are constructed by the *ad hoc* selection of attributes relating to the shape of the lithic (lithic=stone) object. It was the use of such *fossiles directeurs* that enabled Goodwin and Van Riet Lowe (1929) to create a chronological division of the southern African lithics into the ESA, MSA and LSA. These terms are still widely used to describe the southern African lithic occurrences.

The functions of the various classes of artefacts within each of these periods are usually inferred by morphology and lithic tool names typically imply use for a specific task (and often a single function), for example a handaxe or a scraper. A term such as "scraper" refers to the morphological shape as well as to the function of the artefact. Different shapes of, for example scrapers, often result from use and the resharpening of tools rather than different mental templates. Such functional interpretations are often correct, but the form of an artefact does not necessarily match its inferred function. Lithic studies support multi-functional usage of tools with form not always equating assumed function (Andrefsky 2005:201).

An alternative framework: modes of stone tool production (based on Barham and Mitchell :2008)

For some time now researchers have been dissatisfied with the current Three-Age classificatory system that implies rigid boundaries and subsumes the similarities but also the diversities that are usually present within the various periods. Increasing evidence for a quite markedly time lag apparent in some regions for the transition into new industries, e.g. for a late continuation of the MSA in some regions in southern Africa, led to the revival of the use of **modes** to describe technological stages (Barham and Mitchell 2008:16).

In 1969 Grahame Clarke developed a system of five successive modes that describe **broad** patterns in stone tool manufacture. The system avoids the association of particular tools with bounded periods of time and emphasizes that processes of change were probably more gradual and continuous given that certain tool types are not restricted to a specific period so that developments within the various periods represent continuous processes of change. Any one assemblage can accordingly contain artefacts of various Modes, e.g. in an Acheulean assemblage there may be mostly Mode 2 bifacially-worked tools, but also Mode 3 (Levallois debitage) and Mode 5 (blades). An MSA assemblage can have all of these plus Mode 5 artefacts (Willoughby 2008).

However, our current use of the terminology proposed by Goodwin and van Riet Lowe (1929) is so widely cited in the literature and still applied by archaeologists working in southern African contexts that the following system of Modes as set out in Table 1 is merely an alternative framework that can be used in conjunction with the well-established terminology for the different stages of the southern African Stone Age.

Note that this classification system may be particularly applicable for CRM purposes and perhaps easier to understand for people outside the field of archaeology:

Table 1 Modes of lithic technology (after JCD Clark 1969) (Barham and Mitchell 2008:16)		**Notes on different Modes**
Mode 1	Pebble tool industries using choppers and simple flakes struck off pebbles	Mode 1 and 2: mostly **ESA**
Mode 2	Bifacially-worked tools (handaxes and cleavers) produced from large flakes and cores	**ESA Acheulean** Transitional industries such as the **Fauresmith:** a blend of Mode 2 and 3
Mode 3	Flake tools produced from prepared cores	Mode 3 and 4: mostly **MSA**
Mode 4	Punch-struck blades that may be retouched into various specialised tool types	
Mode 5	Microlithic components of composite artefacts, often backed or otherwise retouched	Mode 5: mostly **LSA**, elements of Mode 4, particularly during the early stages, are quite prominent

Table 2 Basic stone tool terminology

A core is a block of raw material from which flake-blades or bladelets have been removed. It is classified as a core only if there are at least three negative flake removal scars. Cores generally show much morphological variability and the size of raw materials influences the kind or reduction technology used (Andrefsky 2005).

A flake is a fragment of stone which has been removed from a core. Such a blank can be used to manufacture a variety of tools. The tiny flakes removed when shaping a flake blank are also called flakes (see retouch below). Flakes, but also bladelets and blades, are the main products of any reduction process.

Detached flakes are often classified as debitage (Andrefsky 2005). However, flakes were undoubtedly used for a variety of tasks on wood, meat and bone as suggested by artefact function studies and supported by ethnographic accounts (Van der Ryst 2006).

Retouch is when small flakes or chips are removed from a blank flake in order to shape or transform a flake into a tool. Retouch shows in tiny regular negative scars on the tool.

Overview of the southern African Stone Age sequence

Table 3 Archaeological context: sequence and definitions

Period	Approximate dates
Earlier Stone Age	more than 2 million years ago - 250 000/200 000 years ago
Middle Stone Age	200 000/250 000 years ago – 25 000 years ago to around the Last Glacial Maximum (LGM) in some regions
Later Stone Age	25 000 years ago - AD 200 and up to historic times in certain areas

The Earlier Stone Age

The two major stone tool industries associated with the ESA are the Oldowan and the Acheulean. The gracile and robust australopithecines are the earliest kinds of hominins to occur in southern African Plio-Pleistocene deposits at around 3 million years ago (mya) while specimens of the genus *Homo* are present at around 2 mya (Mitchell 2002:47). However, we cannot be sure which of the early hominin species produced the tools. The hand morphology of the early South African hominins exhibits precision gripping, which would have enabled tool manufacture. Chimpanzees both use and make tools, and it is therefore very likely that all hominins had this ability (Barham and Mitchell 2008).

The Oldowan

Oldowan assemblages, which are representative of some of the oldest type of stone tools from the ESA, have been recovered from only a few localities in southern Africa. Oldowan assemblages are informal and a restricted range of artefacts includes mainly hammer stones, chunks, chips, flakes (of which some exhibit retouching), as well as cores. This is the period during which both robust australopithecines and early *Homo* are found at these sites. It is generally assumed that the tools were made by *Homo habilis*. The most typical tool of this industry is the **chopper**, where both sides of a cobble were worked to obtain an irregular chopping edge. It is an all-purpose, generalised chopping tool with a sharp edge effective for cutting and chopping. Flake tools form part of Oldowan assemblages and could have been used for a variety of activities.

Flaked and detached pieces: In ESA assemblages it can be difficult to distinguish between some tool types, for example between a chopper tool and a pebble core with negative flake removal scars. Some researchers accordingly prefer to call the cores/objective stone blocks from which flakes have been removed "**flaked pieces**" (FPs) while the flakes detached from the objective piece and the flakes, blades, etc. that have been removed are termed "**detached pieces**" (DPs) (Willoughby 2008).

The presence of cutmarks on animal bones, but also microwear and functional studies, suggest that flakes without any secondary retouch are multi-functional tools and employed in scraping, cutting and also butchering (Mitchell 2002:56). Bone tools are also a feature of these early assemblages. A study of wear patterns on long-bone bone flakes suggests their use in termite collecting (Backwell and d'Errico 2001).

The Acheulean

The Acheulean industry developed from the Oldowan industry. The transition from *Homo habilis* to *Homo erectus* appears to have been closely associated with the development of a new stone tool technology about 1.5 mya. The handaxes and cleavers that typify the Acheulean represent the first lithic expressions to have a wide geographic spread (Deacon and Deacon 1999). For more than a million years the characteristic Acheulean handaxes and cleavers were produced. Mitchell (2002:59) says that the Acheulean is "[p]robably the longest-lasting artefact tradition ever created by hominins" and found "from Cape Town to north-western Europe and as far as India between 1.4 and 0.2 mya". These large tools are considered a product of social learning within cooperating groups (McNabb et al 2004:653). Acheulean tools appear more standardized and to have been shaped by regular blows, rather than random strikes as in the case of the Oldowan. However, the 2.5 million-year-old artefacts from Gona in East Africa, associated with *Homo habilis,* are not obviously more rudimentary than the 1.8 million-year-old artefacts from Olduvai (Deacon and Deacon 1999:77).

ESA Acheulean large cutting tools

Large cutting tools (LCT) of the Acheulean made their appearance nearly synchronous with that of *Homo ergaster* at 1.8 mya (McNabb et al 2004:653). The characteristic lithics of this period are collectively called **bifaces** as they show secondary flaking/retouch on both surfaces where flakes have been removed to shape and sharpen the tools. These artefacts were made to a pattern and according to Deacon and Deacon (1999:79) they "mark the beginnings of style". Pointed bifaces are known as **handaxes**, and bifaces with a wide, transverse cutting edge are termed **cleavers**. The handaxe is often a core tool made by removing many flakes off both sides of a pebble to produce a pear/almond-shaped tool with sharp cutting edges all the way around and a pick-like point. They were also made on flakes, particular during the later phases. The handaxe was a versatile tool and probably used for many different functions.

The emergence of LCT manufacture was earlier in sub-Saharan African than elsewhere (N Rolland in McNabb et al 2004:670). Handaxes and cleavers were manufactured on a cobble/pebble core or on a flake. LCT's varied considerably in size and shape. Some constraints on the morphology of the tool include the quality of available raw material, the size and shape of the pebble or core stone, the nature of the blank produced and the skill of the individual knapper. The majority of LCT's received a minimum of secondary shaping. Cleavers were typically made on side-struck flakes obtained from large cores and minimally shaped. Handaxes with focus on the convergent tips were shaped through invasive flaking and secondary retouch and were most likely to be resharpened or trimmed to extend their use-life. Some bifaces were manufactured, transported and discarded without much resharpening (McNabb et al 2004:669). Resharpening results in size reduction and can account for smaller handaxes in a collection. However, small refined handaxes is also a characteristic of the Fauresmith Industrial Complex.

Some Acheulean handaxes were evidently shaped to obtain balance or symmetry (T Wynn in McNabb et al 2004:672). It is argued that symmetry or near-symmetry could reflect the handwork of more skilled artisans (McNabb et al 2004:668). Many of the handaxes from the Northern Cape certainly exhibit symmetry and examples from Kathu Pan, made on banded ironstone, are particularly fine.

Flake tools were also used during the Acheulean period. There is evidence that flakes were not just the by-products of making core tools; rather, these flakes were deliberately struck from a core and then retouched to sharpen the edges. The Acheulean is characterised by a wider variety of tools, including chisels, anvils, awls and scrapers. The Acheulean toolmaker was also aware of the need to select materials carefully and fine-grained rocks, in particular igneous rocks, were chosen above any others for the manufacture of tools.

A new method of flaking was developed during this period. Instead of using a rock harder than the core from which the tool was to be made, the toolmaker used the soft-hammer percussion technique. By using a material like bone, wood or horn it is possible to knock flakes off with much greater precision than when using a harder rock. This basic toolkit remained the same for about 1.4 million years.

The Fauresmith

The Fauresmith is regarded to represent a transitional phase between the ESA and MSA, and have some technological and typological elements of the latter. There is a tendency towards smaller tools and small handaxes in particular seem to a characteristic feature of the Fauresmith. Assemblages include refined handaxes, long blades, convergent flakes/points, scrapers and prepared cores used in the manufacture of these tool types. This combination of Modes 2 and 3 makes it a likely transitional industry (Barham and Mitchell 2008:229).

The Middle Stone Age

Within the long span within of the MSA, older and younger assemblages are apparent. The earliest MSA assemblages date to around 250/200 000 years ago, but are more widespread from the Last Interglacial (OIS 5) (Mitchell 2002:80). A fourfold scheme is mostly used to describe subdivisions within the southern African MSA lithic assemblages. There is much variability in raw material usage and artefact morphology, and often low frequencies of formally retouched artefact types. During the MSA cores were prepared in order to produce pre-determined shaped blanks which were subsequently used to manufacture different tool types. The characteristic triangular flakes were used to produce retouched unifacial and bifacial points. Long narrow blade flakes occur in a range of sizes. They were used for different activities without any further trimming, but also shaped into specialised tool types.

Long MSA sequences from a particular site often do not exhibit clear technological and typological divisions and also may not contain all the different MSA sub-divisions (Thackeray 1992:397-8). Within the MSA regional traditions, such as Stillbay and the microlithic Howiesons Poort, have been identified. The origins of modern culture and language are associated with the emergence of anatomical modern humans, *Homo sapiens*, during the MSA (McBrearty and Brooks 2000; Willoughby 2008).

The Later Stone Age

The major changes are the replacement of MSA lithic technologies by LSA microlithic stone-working traditions and the widespread signs of symbolic and ritual activity in the form of art and decorative items, and in particular objects made for personal adornment, such as pendants and the ubiquitous ostrich eggshell beads (Mitchell 2002:106). The transition from the MSA to the LSA is vague. Dates proposed for the transitional period range from around 60/40 000-20 000 years ago and are based on a series of dates obtained through different dating methods, palaeoclimatic inferences, as well as lithic technologies and diagnostic tool types as artefactual markers of a particular period. LSA lithic technology is marked by the use of sophisticated knapping techniques, microlithisation, composite tools and a more varied range of raw materials for a greater range of tools as well as higher relative frequencies for bone and shell artefacts (Deacon 1984; Wadley 1993).