Specialist report on the Stone Age occurrences documented for the Mogalakwena Mine Expansion Project near Mokopane, Limpopo

Compiled by Dr MM van der Ryst

Commissioned by PGS Heritage

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Declaration of independence

This report has been compiled by Dr M.M. van der Ryst. I declare that as independent consultant I have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity or application.

Note that a copy of the report will be lodged with SAHRA as stipulated by the NHRA (Act No. 25 of 1999), Section 38 (particularly subsection 4).

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List of acronyms

AIA	Archaeological Impact Assessment
ASAPA	Association of Southern African Professional Archaeologists
BAR	Basic Assessment Report
BIFs	Banded Ironstone Formations
BP	Before Present
CFP	Change Find Procedure
ESA	Earlier Stone Age
HIA	Heritage Impact Assessment
LCTs	Large Cutting Tools
LSA	Later Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act (No. 25 of 1999)
OES	Ostrich Eggshell
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
STPs	Shovel Test Pits
ToR	Terms of Reference

1 Executive summary

As a Stone Age specialist accredited with ASAPA, I assessed the Stone Age lithics that have been recorded during the HIA for the Mogalakwena Mine Expansion Project near Mokopane, Limpopo Province. The Mogalakwena Mine owned by Rustenburg Platinum Mines Ltd is a wholly owned subsidiary of Anglo American Platinum. The Mogalakwena Mine has been operational since 1992 and the expected Life of Mine is in excess of 50 years (PGS 2019: 4). The HIA was conducted during September 2019 by Polke Birkholtz of PGS Heritage for SRK Consulting (Pty) Ltd. The study area, located on sections of the farms Overysel 815 LR, Zwartfontein 818 LR, Vaalkop 819 LR and Blinkwater 820 LR, falls under the Mapela Traditional Authority and the Mogalakwena Local Municipality, Limpopo Province (PGS 2019).

SAHRA (2007: 7) defines Heritage Impact Assessments (HIAs) as 'studies conducted by qualified heritage specialists that aim to identify heritage resources within a proposed development area, assess their significance, assess the impact of the development on the heritage resources and provide relevant mitigation measures to alleviate impacts to the heritage resources'. During the survey Birkholtz of PGS (2019) recorded 12 surface scatters of mainly Middle Stone Age (MSA) lithics. The general landscape setting of the various archaeological sites and a selection of surface lithics were photographed. Visibility was high in the generally eroded areas where stone tools were observed. Observably density of scatters were preliminary assessed, and these were mostly low with <10 lithic elements per square meter. Sites MMEP5, MMEP6, MMEP47 and MMEP49 that would be impacted by the proposed development were assessed and rated to be of medium significance (see section 2 for the criteria used in assignment site significance).

PGS Heritage proactively decided that it was important to record some of the MSA localities. According to the *SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports* for sites that cannot or need not be saved from development but carry information of significance about the past, the archaeologist will recommend a Phase 2 Archaeological Mitigation (SAHRA 2007: 4). A great many Stone Age sites have been documented through predevelopment Heritage Impact Assessments (HIAs) and Archaeological Impact Assessments (AIAs). At a time when cultural research management was still a relatively new concept, Schiffer et al. (1977: 44) argued that 'management research can and must produce, and is producing, significant contributions to scientific archaeology'. The recording of Stone Age assemblages documented through impact assessments at a great variety of sites in the Limpopo Province has added immeasurably to the data base on the Stone Age prehistory of the region.

PGS in their 2019 HIA report therefore recommended that some of the localities should be mitigated and documented in more detail. This would comprise in situ recording of selected lithic scatters to determine the varying densities, tool types and raw material use (see section 3). PGS Heritage subsequently commissioned the writer of this report to undertake an assessment of the documented stone tools from the various identified localities and to make recommendations on the significance of the finds. The authorisation of a Section 35 Permit was not required since no lithics were removed from their contexts.

During the March 2021 visit to the identified MSA localities non-invasive in situ recording was carried out. The tools were not collected in view of the observed generally low densities. The grid documentation was used to obtain more data on lithic densities on the spatial distribution patterning. A one-metre grid square was used in four areas where fairly higher densities of stone artefacts were observed. A total of 13 grids were established. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of (<10), medium (10-20) and high (>20). The archaeologists recorded mostly low densities <10, with a single instance of medium density with 15 lithic elements. The landscape setting of each locality was photographed and the lithics within each of the grids were photographed. The artefacts all exhibit a MSA signature with the exception of one Later Stone Age (LSA) specimen and an undecorated potsherd.

The significance of the impact of the development during a pre-mitigation Medium Significance is supported by the post-mitigation Medium Significance based on the data collected during the 2021 non-invasive documentation and subsequent analyses. A fairly low-scale utilization of resources during the MSA is reflected by the relatively low numbers and densities of lithics, and the somewhat limited range of formal tool types recorded on the surface at localities MMEP5, MMEP6, MMEP47 and MMEP49. While the documentation reflected the distribution of artefacts on the surface, the recorded densities were unfortunately too low to allow any inferences on spatial patterning. The lithics were mostly present on calcrete or pebble surfaces. No subsurface lithics were observed in the walls of the eroded gullies. The author of this report is confident that the lithic occurrences of the property under review were adequately documented and assessed during the 2019 HIA and the subsequent survey and documentation during March 2021 and lastly, this report by a Stone Age specialist. No further mitigation actions are required. PGS has the experience and knowledge to apply for exemption.

2 Introduction and background to the project

2.1 Purpose and terms of reference

This report details the investigation of Stone Age occurrences previously identified during a HIA undertaken during September 2019 by Polke Birkholtz of PGS as commissioned by SRK Consulting (Pty) Ltd. The HIA was required for the Mogalakwena Mine Expansion Project near Mokopane, Limpopo (Fig. 1). The study area, located on sections of the farms Overysel 815 LR, Zwartfontein 818 LR, Vaalkop 819 LR and Blinkwater 820 LR, falls under the Mapela Traditional Authority and the Mogalakwena Local Municipality, Limpopo Province (PGS 2019).

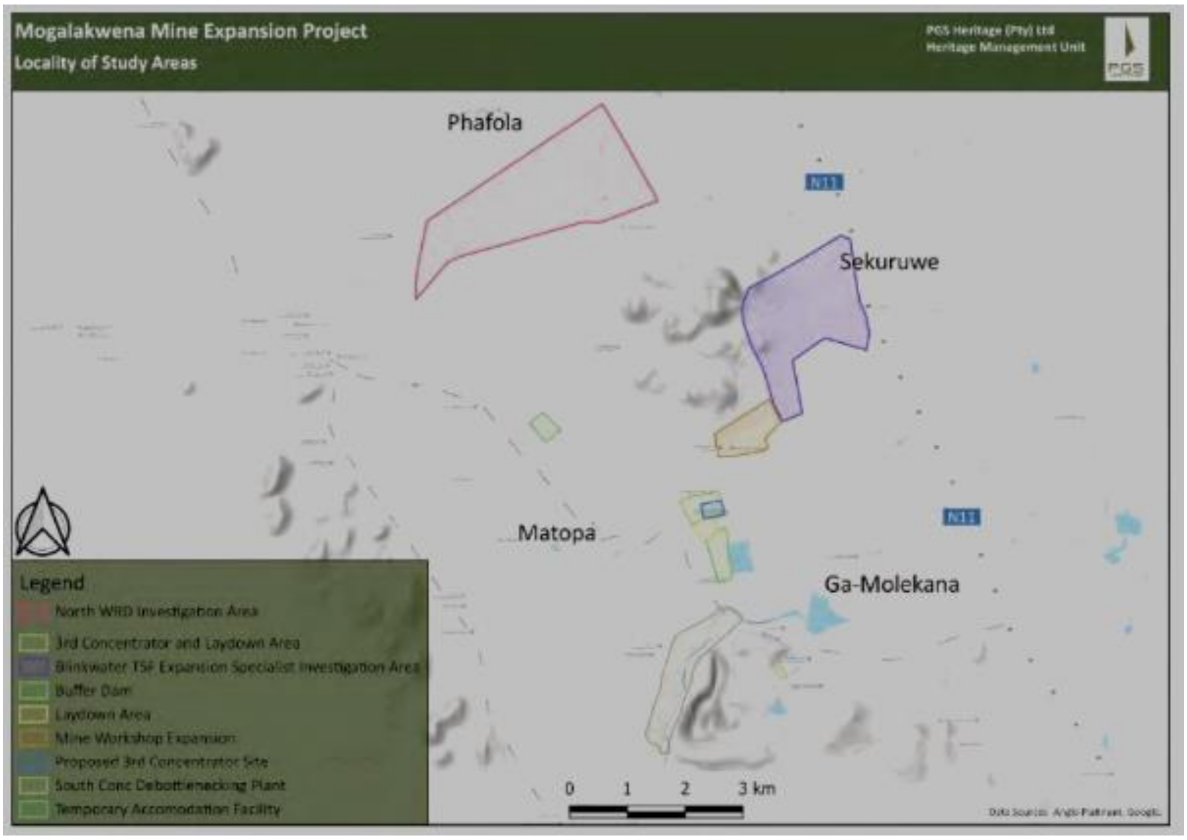

Figure 1. *The Mogalakwena Mine Expansion Project. The town of Mokopane lies to the south (PGS 2019: 5).*

MSA lithics were identified at 12 localities during the HIA (MMEP1, MMEP5, MMEP6, MMEP8, MMEP9, MMEP15, MMEP47, MMEP48, MMEP 9, MMEP52, MMEP60 and MMEP67). The significance of heritage sites was based on five main criteria (PGS 2019: 6-7):

- Site integrity (i.e. primary vs. secondary context);
- Volume of deposit, range of features (stone tools);
- Density of lithic scatters:
  - Low (<10)
  - Medium (10-20)
  - High (>20).
- Uniqueness; and
- Potential to contribute to research.

Site significance was established for each of the lithic occurrences. In the assessment of significance four localities, namely MMEP5, MMEP6, MMEP47 and MMEP49, were selected for mitigation based on the density and nature of the lithics and their location within the proposed development. The sites were observed to contain mainly low , and some medium density surface occurrences of MSA tool types. (See PGS 2019; 223 Table 12: *Assessment of Post-Mitigated Impact of Proposed Development on Stone Age sites assessed during the fieldwork to be of Medium Significance*).

Most of the MMEP lithics occur in calcrete formations within gullies and dongas. Continuous and discontinuous gullies are evident across the area where the archaeological materials were recorded.

In the process of gully formation water concentrates in narrow flow paths and removes the soil, which results in incised channels (Le Roux & Sumner 2012). Various post-depositional site processes can account for the accumulation of the lithics. A past landscape surface can be buried, eroded, or modified by sequential human activities or geomorphological processes (Zvelebil et al. 1992). Vertical disturbance and displacements in particular may impact the stratigraphic contexts (Driese et al. 2013). It is most likely that the surface areas on which the MMEP lithics occur are remnants of formerly larger concentrations, sections of which were eroded away by gully and donga formation and exposed through soil loss. Alternatively, but less likely, the lithics could have been translocated from their original deposition at higher-lying sites by water and other erosional mechanisms.

The SAHRA APM Guidelines: Minimum Standards SAHRA (2007: 7) on mitigation measures assert that '[w]here it is not possible to retain the heritage resources in situ, and the heritage resources are not deemed significant, the loss of information can be reduced by recording and mitigation of the heritage resources through a process of excavation (or sampling) by a qualified specialist as a condition on the development in terms of section 38(4)d ….' This allows us to record a part of the history of the place as part of the national inventory. Assessment and mitigation in the early phase of the development may save the developer considerable delays and related costs'.

Mitigation measures proposed by PGS (2019) included the commissioning of a Stone Age specialist to provide specialist input on the Stone Age assemblages documented during the HIA. Another site visit was subsequently undertaken by PGS archaeologists and a field assistant in March 2021 to record the various occurrences, densities and typologies of the Stone Age lithics at the four sites that were deemed of significance. This report provides context on the various stone tool assemblages from the five targeted sites based on the field data of two surveys and subsequent typological analyses.

3 Methodology

- During the HIA conducted by PGS (2019) the study area was walked to identify heritage resources that included surface lithic.

- During both the 2019 HIA (PGS 2019) and the March 2021 surveys, the distribution and densities of surface Stone Age occurrences were evaluated according to the South African Heritage Resources Minimum Standards: Archaeological and Palaeontological components of Impact Assessment Reports (SAHRA 2007).

- Anglo American adhered to the lockdown Covid restrictions in place at the time whereby management did not allow individuals of >60 years of age or with comorbidities on any of their properties. It was accordingly proposed that archaeologists at PGS should visit the MSA localities during March 2021. The author of this report gave a detailed list of instructions to the archaeologists as to the survey and the information required to make an informed decision on the attributes of the lithics (Van der Ryst 2018a, 2020b). These include the distribution patterns of the lithics, the densities in which these occur and data on the artefact-bearing soils.

- A document that details macroscopic typo-technological analyses of lithics was also provided to PGS. In this document the author gives a broad framework of the various Stone Age periods, the general principles in connection with the manufacture of stone implements, as well as Earlier, Middle and Later Stone Age typologies. The document outlines different classificatory systems used in southern Africa to analyse lithics from the various chronological divisions of the Stone Age succession (Goodwin & Van Riet Lowe 1929; Clark 1969, 1988; Deacon 1984a, 1984b; Deacon & Deacon 1999; Thackeray 1992; Wadley 1993, 2005c, 2015; Barham & Mitchell 2008; Lombard et al. 2012; Dusseldorp et al. 2013).

- During the follow-up conducted in March 2021 by archaeologists Cherene de Bruyn and Michelle Sachse, and archaeological field technician Thomas Mulaudzi, additional recordings of lithics and densities of the surface lithics at the various localities were made following general archaeological methodologies.

- The process of assessment for an Phase 2 Mitigation/Rescue, as described by SAHRA (2007: 2) involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost.

- Four localities recorded during the HIA were mitigated through an in situ documentation of lithics and lithic densities without collecting any (PGS 2019). During the 2021 site assessment non-invasive in situ recording was carried out to establish spatial distribution patterning and lithic densities. A grid documentation was used to obtain more data on lithic densities on conceivably the spatial distribution patterning. Tape measures were used to establish a one-metre grid square in areas where marginal higher densities of stone artefacts were observed. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of low (<10), medium (10-20) and high (>20). This was not an excavation but a controlled recording of low density occurrences of lithics from disturbed contexts that do not require a permit from SAHRA.

- This is an expedient and non-invasive strategy that is particularly useful in the value assessment of lithic occurrences. In the 2019 survey PGS (2019) used the density of the accumulated lithic assemblage at all the recorded surface MSA sites to assign significance. An assessment of significance that is based on defined parameters promotes the design of appropriate mitigation strategies with regard to intervention measures, sampling methods and a responsible budget. The assessment of value is fundamental for heritage projects as it aids planning and decision-making strategies (Mason 2002).

- A total of 13 grids were established. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of (<10), medium (10-20) and high (>20). The March 2021 assessment and in situ recording of stone tools established that stone tools and debitage were present in low densities of 5–10 lithics per square meter, with a medium density of 15 lithic elements at one spot. The assessment considered the five main criteria as applied in the initial survey (PGS 2019: 6-7). The landscape setting of each locality was photographed and the lithics within each of the grids were photographed. The artefacts all exhibit a MSA signature with the exception of one Later Stone Age (LSA) specimen.

- A desktop study of existing literature on the Stone Age of the wider region was conducted to assess the heritage context (Section 5). The SAHRIS data base was also accessed for previous heritage reports that relate to the general region of the survey.

- The Catalogue of Stone Age artefacts from Southern Africa in the British Museum is a valuable source too since it lists early collections of stone tools with the localities where these were obtained from (Mitchell 2002b).

- Different classificatory systems used in southern Africa to analyse lithics from the various chronological divisions of the Stone Age succession (Goodwin & Van Riet Lowe 1929; Clark 1969, 1988; Deacon 1984a, 1984b; Deacon & Deacon 1999; Thackeray 1992; Wadley 1993, 2005, 2015; Barham & Mitchell 2008; Lombard et al. 2012; Dusseldorp et al. 2013; Wadley, L. n.d.). Each of the subdivisions is formed by a group of industries where the assemblages share attributes or common traditions (Deacon & Deacon 1999; Lombard et al. 2012). The typology of the MMEP tool types was broadly based on Deacon 1984a, 1984b; Barham & Mitchell 2008; and Lombard et al. 2012.
  Wadley, L. n.d. Wadley, L. n.d.

4 The archaeological and historical settlement within the study area

Polke Birkholtz of PGS (2019) provides detail on the various phases of settlement in the study area. AIAs, HIAs and academic publications on the prehistory and historical period generated a data base for the general area. These sources demonstrated a diverse cultural landscape with settlement and utilization of the local resources starting from the deep past over a period of time that spans millions of years up to recent times. It documents the earliest occupations of hominins, Stone Age settlement, migrations of African farmers and the later movement of white farmers into the region, mining, industrialization, urbanization, warfare and conflict. See PGS (2019: 49–50) for a summary of the assessments conducted from 2008 to 2017.

5 The MSA of the general region

In this section a brief review of the MSA archaeology of important excavated sites within the broader region is provided (Fig. 2). There are only a few MSA sites within the general region that have been sufficiently recorded and published. Considerable variation is found in the southern African MSA sites, both across space and through time (Wadley 2016). This can to some extent be ascribed to the availability of suitable fine-grained rock types suitable for tool manufacture.

5.1 Olieboomspoort

Preliminary archaeological exploration in the trans-Vaal region was initiated in the 1950s when Revil Mason investigated sites in the area, with small-scale excavations undertaken at several localities to recover data for a compendium, which was subsequently published as *The prehistory of the Transvaal* (1962). Shelters with stratified sequences of both MSA and LSA occupations include Olieboomspoort (OBP) near Lephalale, Cave of Hearths and Mwulu close to the Cave of Hearths (Mason 1962). OBP is one of the few rock shelters in the interior documenting pulses of occupation going back from the Acheulean until the end of the LSA (Val et al. 2021 in press). Mason attributed the OBP MSA lithic assemblage to his middle phase of the so-called Pietersburg industry.

The remarkable lithic assemblages from OBP were instrumental in Mason's identification of the so-called Pietersburg Industry and formed the basis for identifying similar MSA techno-cultural developments in the interior (Mason 1957, 1959, 1962; Underhill 2011; Wadley et al. 2015a; Porraz et al. 2015; de la Peña et al. 2019; Porraz et al. 2018; Douze et al. 2020; Val et al. 2021 in press). In the 1950s MSA assemblages in the interior with a lithic industry containing long blades, truncated blades with retouched edges, and long unifacial points were assigned to the Pietersburg Industry, named after the town of Pietersburg, now Polokwane (Wadley 2016). Wadley (2016: 130) described it as follows: '*Their lithics are mostly made on rocks locally available in sizeable chunks that enable knapping of large, elongated products. The Pietersburg Industry, as presently defined, may well be a response to the availability of hefty blocks of fine-grained rock*.'

OBP was clearly an important place in the landscape over time. The OBP sequence contains an ephemeral ESA followed by a very extensive MSA and again a break in occupation until LSA hunter-gatherers began to use the shelter intensively from at least the early Holocene onwards. During the many thousands of years that humans frequented OBP during the MSA, they brought in enormous quantities of lithics (Mason 1962, 1988; van der Ryst 2006). A date of greater than 33 000 years ago was obtained from the British Museum Research Laboratory for Mason's (1962: 84) MSA Olieboomspoort Pietersburg Culture Middle Stage. OBP is also cited for the remarkably large assemblages of ochre recovered from the MSA contexts (Mason 1962, 1988; Volman 1984; Watts 1998, 2002; Mitchell 2002a; Wadley 2005a, 2005b).

While recent work at OBP yielded data on the LSA (van der Ryst 2006), little is known about the earlier phases of occupation of the shelter. The undated MSA deposits are capped by LSA deposits with Bambata pottery. Research on the archaeology and environment OBP reflects the importance of this locality (Sievers et al. 2020; Val et al. 2021 in press). Excavations at Olieboomspoort have been resumed by Dr Aurore Val, formerly of Wits and now at Tübingen University, Germany who directs the Olieboomspoort collective research project. It aims to provide a chronological framework for human use of the shelter (and in particular during the MSA), to investigate site formation processes and to obtain proxy data for palaeoclimatic and palaeoenvironmental reconstructions across the Savanna Biome during the Late Pleistocene. The project has already yielded important data, for example the recovery of nine equid teeth. While full morphological descriptions are still pending, the faunal remains are tentatively attributed to the extinct giant Cape horse, *Equus* cf. *capensis* (Val et al. 2021 in press). Two of the teeth were submitted for dating, and yielded estimates at ~150 ka. These fossils can securely be dated to Marine Isotopic Stage 6(MIS)[1] (Val et al. 2021 in press).

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[1] Marine Isotope Stages (MIS) are the chronological listing of alternating cold and warm periods of the global oxygen isotope record that reflects palaeoclimatic changes. The Holocene is the present geological epoch. The Holocene began approximately 10 000 years ago following on the Pleistocene, which is the first geological epoch

5.2 Cave of Hearths

The Cave of Hearths in the Makapans Valley preserves a complete sequence of human occupation ranging from the ESA Acheulean, a particularly long MSA Pietersburg sequence, LSA deposits and up to the Iron Age. Mason divided the MSA deposit into seven stratified industries of the Pietersburg, namely Beds 4 to 9. These were then used as a standard for other MSA assemblages. Surface finds include European artefacts. Mason excavated this locality in 1953–1954. Mason (1962: 74) attributed the lithics excavated from Beds 4 and 5 to the Earlier and Middle Pietersburg Culture. Of note are the ball-shaped stone objects, referred to as spheroids, that were present in the ESA and the MSA levels (Mason 1988; Wilson et al. 2016). These naturally shaped and/or fabricated stones are inferred to be percussive tools used in the production of lithics, and even projectile weapons.

5.3 Kalkbank

Kalkbank is located around 64 km northwest of Polokwane. The surface calcretes extend over several acres associated with relict water accumulations (Hutson & Cain 2008). Mason (1962) recorded MSA deposits at this open-air locality, which was excavated in 1954 and 1966. Large accumulations of animal bones were preserved alongside MSA stone tools (Ewer 1958, 1962; Mason 1962). He remarked on the diversity of MSA technology, writing that '[l]ocalities like Kalkbank demonstrate the flexibility of Middle Stone Age tool-making' (Mason 1962: 250). The area had abundant food sources with a broad range of game animals, but offered poor quality rock types for toolmaking. At this locality bone was extensively used for tools with remarkably low numbers of stone tools (Mason 1962). A recent taphonomic analysis of the fauna demonstrated a significant carnivore role in the accumulation of the faunal assemblage. The locality is inferred to be a predation site where carnivores ambushed prey near the margins of the pan (Hutson & Cain 2008).

5.4 Mwulu's Cave

This locality near Makapansgat in the Limpopo Province was first investigated by Phillip Tobias (1949). Multi-disciplinary research was subsequently undertaken with the aim to investigate the chronological, technological and cultural characteristics of the MSA from the interior (de la Peña et al. 2019). The results of the earlier and more recent excavations at OBP (van der Ryst 2006; Val et al. 2021 in press), current work at Bushman Rock Shelter (Porraz et al. 2018), Heuningneskrans (Porraz & Val 2019) and Mwulu's Cave (de la Peña et al. 2019) stimulated new interest in Mason's Pietersburg MSA industry (Val et al. 2021 in press). The MSA at Mwulu's is attributed to the Middle-Late Pietersburg. Pietersburg localities are limited to the Savanna Biome (Mason 1957, 1962; Val et al. 2021 in press) (Fig. 2). Some of these archaeological investigations have already yielded MSA dates from the end of MIS 5 at Bushman Rock Shelter (Porraz et al. 2018) and Mwulu's Cave (Feathers et al. 2020).

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of the Quaternary period. The current Holocene is therefore the second epoch of the Quaternary period. It is a warm period, known as Marine Isotope Stage 1 (MIS 1).

5.5 North Brabant

Small-scale investigations at the North Brabant rock shelter in the western Waterberg demonstrated a similar cultural sequence to OBP (Schoonraad & Beaumont 1968). The lower deposit was assigned to a Middle Pietersburg MSA assemblages. The undated MSA deposits are overlain by LSA deposits with Bambata pottery.

5.6 Goergap

Archaeological sites in the drainage system of the Lephalala River on the Waterberg Plateau, and in particular Goergap shelter, also featured in research (Van der Ryst 1998, 2003). The sequence on the plateau shows a relatively extensive MSA occupation, followed by a very long period of non-occupation as established from other excavated shelter sites. Intensive occupation of the plateau by hunter-gatherers is found only at approximately 800 years ago. The MSA at Goergap was more ephemeral. Very large blades on sandstone were present in the earliest MSA levels. Some recycling of low numbers of MSA tools by the much more recent LSA hunting and gathering communities was also found at Goergap (Van der Ryst 1996, 1998).

5.7 Steenbokfontein

Steenbokfontein is a MSA spring site in the Waterberg, Limpopo. It is located on the farm with the eponymous name, Steenbokfontein 9KR on the Waterberg Plateau. An outcrop of silicified siltstone is exposed at the spring. The availability of water and siliceous rock that featured prominently in the production of the lithic assemblage probably attracted Stone Age utilization of the resources at this locality. MSA flakes and blades made on silicified siltstone were produced on site. The MSA assemblage excavated at Steenbokfontein was defined as undiagnostic (Wadley et al. 2016).

5.8 Wonderkrater

Sediment cores from this locality extracted to reconstruct climate change, yielded MSA artefacts. The subsequent excavations produced three small lithic assemblages, with age estimates of 30 ka, >45 ka and 138.01 ± 7.7 ka[2] (Backwell et al. 2014: 42). The sediments contained late Pleistocene fauna and flora, and the human occupations occurred during MIS 3e1 and MIS 6 (Barré et al. 2012; Backwell et al. 2014: 42). The lithic assemblages at Wonderkrater were also assigned as a general MSA since the tool types were not diagnostic of the Pietersburg.

5.9 Kudu Koppie

Kudu Koppie is a large sandstone outcrop in the Mapungubwe National Park close to the confluence of the Limpopo and Shashe rivers where South Africa borders on Zimbabwe and Botswana (Pollarolo et al. 2010; Wilkens et al. 2010; Summer & Kuman 2014). It is one of few open-air sites where evidence for both ESA and MSA occupations were found. In such open-air contexts deflation and various other

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[2] ka = thousand years ago

post-depositional processes certainly removed some of the original sediments (Summer & Kuman 2014). Nevertheless, refitting sequences have demonstrated a relatively high stratigraphic integrity (Wilkin et al. 2010). Various core methods were used, including a prepared core reduction that was applied by both ESA and MSA occupants at this locality. The Kudu Koppie lithic assemblage was not diagnostic enough to go beyond a general MSA attribution.

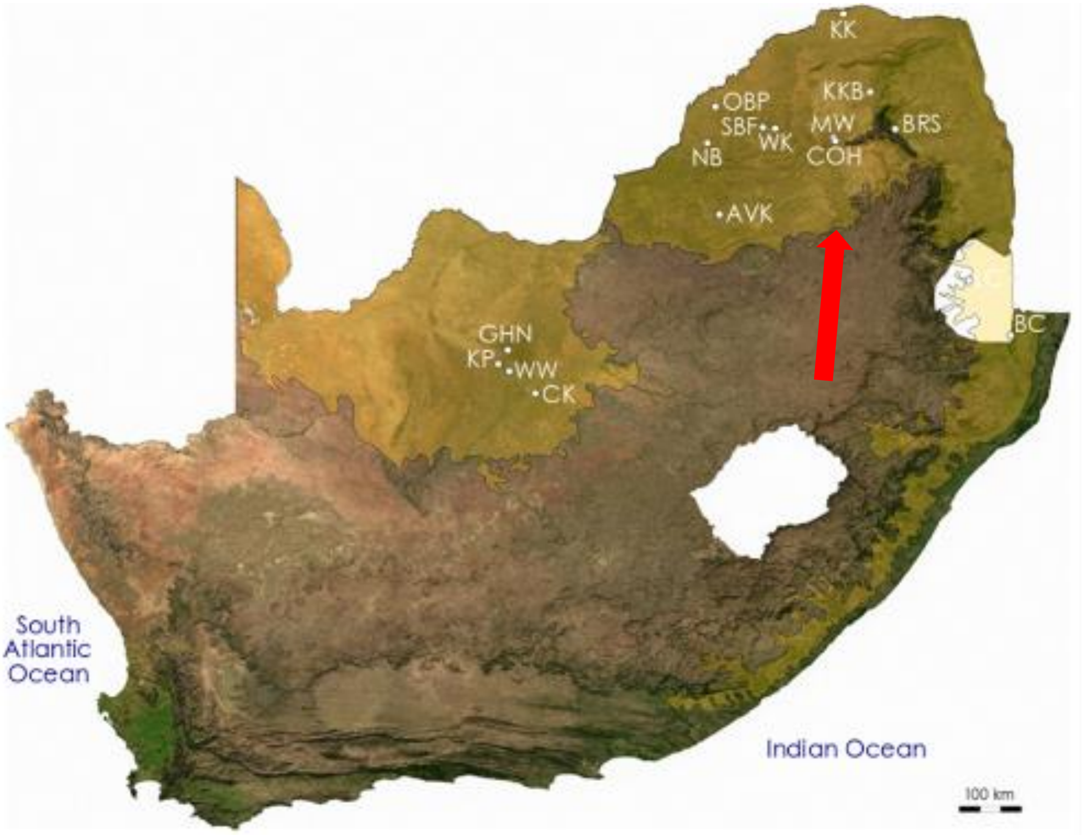

Figure 2. *MSA sites in the Savanna Biome are indicated by the arrow. Sites mentioned in this report are in bold. Abbreviations for site names are: AVK for Aasvoëlkop;* ***BRS*** *for* ***Bushman Rock Shelter****; CK for Canteen Kopje;* ***COH*** *for* ***Cave of Hearths****; GHN: Ga-Mohana Hill North Rockshelter;* ***KK*** *for* ***Kudu Koppie****;* ***KKB*** *for* ***Kalkbank****; KP for Kathu Pan; LC for Lion Cavern;* ***MW*** *for Mwulu's Cave;* ***NB*** *for* ***North Brabant****;* ***OBP*** *for* ***Olieboomspoort****;* ***SBF*** *for* ***Steenbokfontein****;* ***WK*** *for* ***Wonderkrater****; and WW for Wonderwerk Cave (Based on Val et al. 2021: 25/32).*

6 Dates for the MSA

A secure chronology is essential for understanding the past. The MSA of southern Africa began around 300 000 ago with the transition from the ESA to the MSA. Its earliest expressions are still unclear. The MSA is best known for innovations and novel behaviour that appear in the archaeological record at various times after about 200 000 years (Wadley 2015).

Radiocarbon dating is particularly used to estimate the age of materials that originated from living organisms. An age is estimated by measuring the amount of carbon-14 present in the sample and comparing this against an internationally used reference standard. Radiocarbon dating, while eminently suitable to date the LSA, cannot be used to date archaeological assemblages beyond 45 000 years ago (Mitchell 2008). Dendrochronology is the technique of dating events, environmental change, and archaeological timber by using the characteristic patterns of annual growth rings in timber and tree trunks (Dunuweera & Rajapakse 2018). Optically Stimulated Luminescence (OSL), Thermoluminescence (TL) and Electron-spin Resonance (ESR) are used for dating MSA archaeological materials and deposits in southern Africa.

The Marine Isotope timescale is also now widely used in archaeology for the reconstruction of climate and to express relative dates of archaeological occurrences during the Quaternary period (Barham & Mitchell 2008). Marine Isotope Stages (MIS) are the chronological listing of alternating cold and warm periods of the global oxygen isotope record that reflects palaeoclimatic changes. The marine isotope variations are numbered from the top down with warm interglacial stages having odd numbers and cold glacial stages even numbers. The Holocene is MIS 1. The global MIS record provides a framework to structure chronology. While some MSA sites date to MIS 6 (191-130 ka), most of the southern African MSA sites date from MIS 5 (130–71 ka) and up to MIS 3 (57–29 000 ka) (Stewart & Jones 2016).

7 MSA lithics

During the HIA undertaken by PGS Heritage (2019) 12 surface occurrence of Middle Stone Age (MSA) lithics were identified. All archaeological occurrences in South Africa are important for understanding the origins of the genus *Homo* and the evolutionary history of anatomically modern humans (AMH), the utilization of a region by communities up to the recent past, and in particular, land-use patterns and technological developments over a very long period of time that spans millions of years. In view of the different aspects pointed out above it was deemed important that a Stone Age specialist should assess the lithics from the MMEP localities and to provide an informed opinion on the importance of the Stone Age occurrences at the study locality and to provide guidelines on mitigation measures.

Four localities recorded during the HIA were mitigated through an in situ documentation of lithics and densities without collecting any (PGS 2019). In the following section the methodology is discussed. The environment and context of the various sites are illustrated. For each of the 13 grids examples of the lithic elements recorded within each grid are illustrated. The analyses of the MMEP assemblages are discussed in more detail in section 9.

7.1 MMEP5 GPS Coordinates: S 23.95010 E 28.92870

7.1.1 The 2019 HIA documentation and significance

Significance: MMEP5 exhibits a medium lithic density. The site was deemed to be of **Generally Protected B (GP. B) or Medium Significance** (PGS 2019: 72).

NOTE: Please refer to PGS 2019: 8, Table 2 *Site significance classification as prescribed by SAHRA* for detail on the field rating.

7.1.2 2021 Documentation of the MMEP5 assemblage

The site comprises a MSA stone tool scatter in an eroded gully formed through alluvial erosion associated with a non-perennial stream that drains from the north-west. The lithics occur within and on the sides of the eroded gully and mainly within calcrete and on a calcrete surface (Figs 3 to 5). Several of the implements that were documented exhibited mechanical weathering, suggesting an earlier phase of deposition within or on the calcrete. The site extent is approximately 200 m x 20 m. Complete and broken MSA tools such as blades were noted during the 2019 HIA.

Figure 3. *General views of MMEP5 (PGS March 2021).*

Figure 4. *Views of eroded context of MMEP5 (PGS March 2021).*

Figure 5. *Detail of site MMEP5. Note erosion and calcrete encrustation on some of the lithics at MMEP5 (PGS March 2021).*

At MMEP5 three 1 m x 1 m grids (Figs 6 to 10) were placed on selected areas to determine the relative density of lithics. The grids were placed on the areas that exhibited the highest density of lithic material. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of low (<10), medium (10–20) and high (>20). No high-density concentrations of stone tools were evident. The results were as follows:

Grid 1: n=10 (Medium density 10-20) (Figs 6 and 7)
Grid 2: n=3 (Low density <10) (Figs 8 and 9)
Grid 3: n=4 (Low density <10) (Fig. 10)

Figure 6. *Establishing MMEP5 Grid 1 to record density distribution of lithic elements (PGS March 2021).*

Figure 7. *Dorsal and ventral sides of the MMEP5 lithic elements (n=10) from Grid 1 (PGS March 2021).*

Figure 8. *Establishing MMEP5 Grid 2 to record density distribution of lithic (PGS March 2021).*

Figure 9. *Dorsal and ventral sides of the lithic elements (n=3) from MMEP5 Grid 2 (PGS March 2021).*

Figure 10. *Establishing Grid 3. Lithic elements (n=4) from MMEP5 Grid 3 (PGS March 2021).*

Typical MSA tool types in the MMEP lithics are blade forms, points, and medium to large scrapers. The characteristic multifaceted MSA faceted striking platform that derives from a prepared core is evident on the broken blade in Fig. 11 (see arrow). Felsite was the dominant raw material used in the manufacture of the recorded lithics (see section 9 for more detail). Quartz, quartzite and more rarely Cryptocrystalline Silicas (CCS) also featured in the stone tool manufacture, but not to the same extent as Felsite. The presence of a hammer stone used in the process of lithic manufacture suggests some level of in situ production (Fig. 11).

Figure 11. *Surface lithics observed at MMEP5 during the HIA. Scale in 1 cm intervals (PGS 2019: 73). Blades, scraper and flakes. Note hammer stone to the lower left.*[3]

7.2 MMEP6 GPS Coordinates: S 23.94798 E 28.92703

7.2.1 The 2019 HIA documentation

Significance: The site was deemed to be of **Generally Protected B (GP. B) or Medium Significance** (PGS 2019: 75).

7.2.2 2021 Documentation of the MMEP6 assemblage

The site comprises a MSA stone tool scatter of medium to low density in an eroded gully formed through alluvial erosion associated with a non-perennial stream that drains from the north-west (Figs 12 to 13). The site extent is approximately 50 m x 50 m. Lithic tool types such as cores, chunks, flakes, points and blades, made on a variation of raw materials that include quartzite and felsite, were noted. Some of the flaked lithics exhibit retouch. Three undecorated potsherds were also observed (Fig. 22).

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[3] Scale used in lithic photographs is in 1 cm intervals

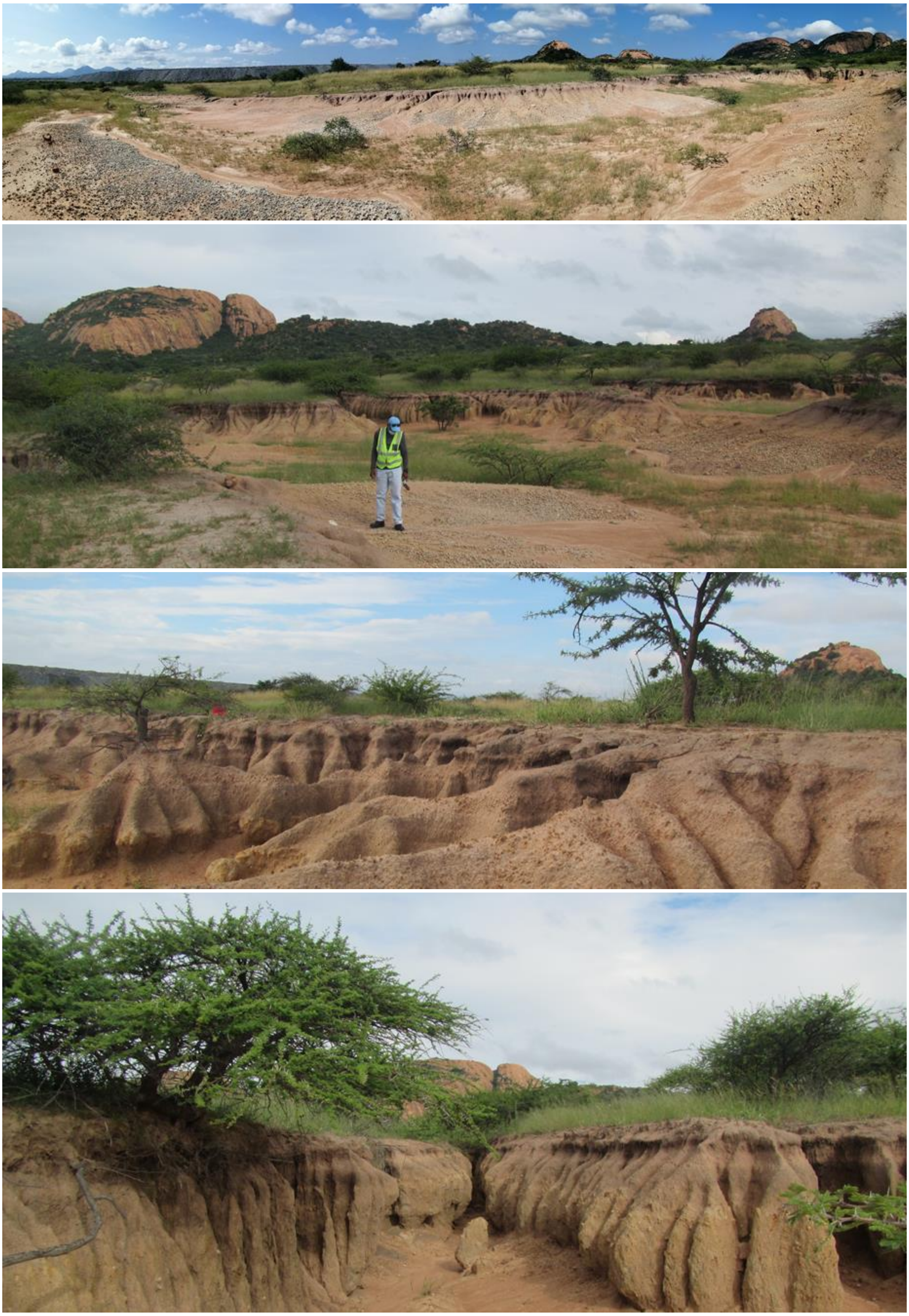

Figure 12. *General views of MMEP6 (PGS March 2021).*

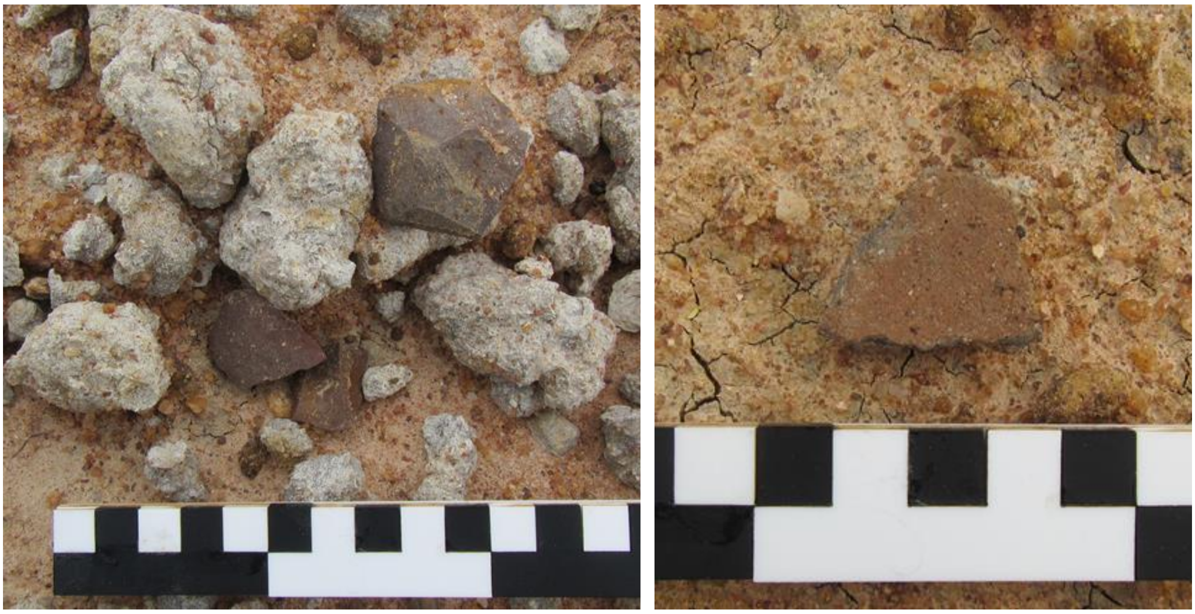

Figure 13. *Detail at MMEP6. Note calcretes, surface lithics and an in situ potsherd (PGS March 2021).*

At MMEP6 four 1 m x 1 m grids (Figs 14 to 21) were placed on selected areas to determine the relative density of lithics. The grids were placed on the areas that exhibited the highest densities. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of low (<10), medium (10–20) and high (>20). No high-density concentrations of stone tools were evident. The results were as follows:

Grid 1: n=6 (low density <10) (Figs 14 and 15)

Grid 2: n=12 (medium densiity 10-20) (Figs 16 and 17)

Grid 3: n=5 (low density <10) (Figs 18 and 19)

Grid 4: n=5 (low density <10) Figs 20 and 21)

Figure 14. *Establishing MMEP6 Grid 1 to record density distribution of lithic (PGS March 2021).*

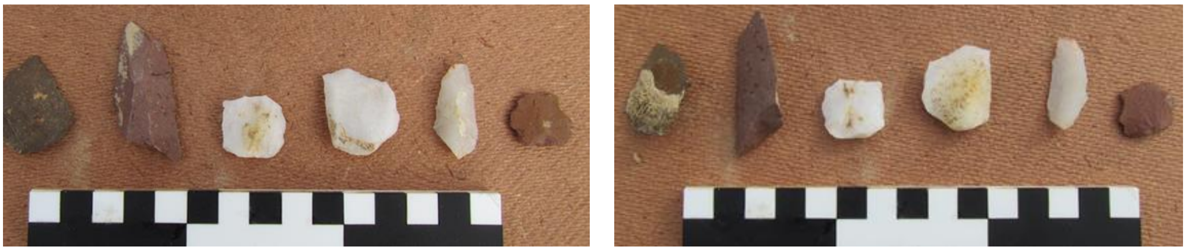

Figure 15. *Dorsal and ventral sides of the MMEP6 lithic elements (n=6) from Grid 1 (PGS March 2021).*

Figure 16. *Establishing MMEP6 Grid 2 to record density distribution of lithic elements (PGS March 2021).*

Figure 17. *The MMEP6 lithic elements (n=12) from Grid 2 (PGS March 2021).*

Figure 18. *Establishing MMEP6 Grid 3 to record density distribution of lithic elements (PGS March 2021).*

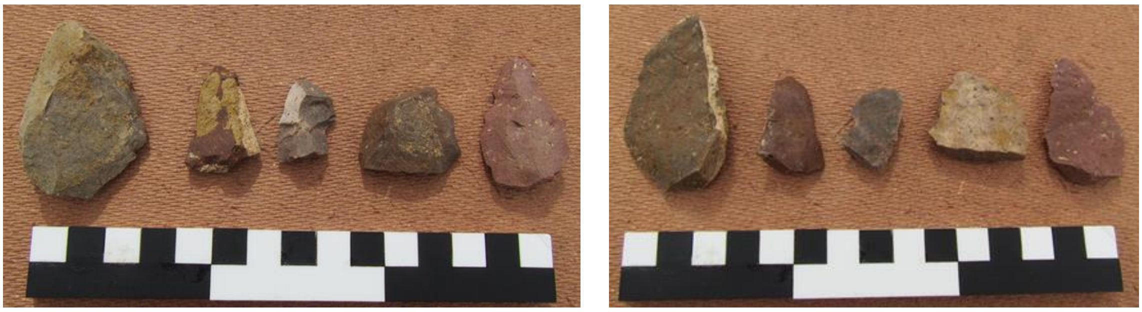

Figure 19. *Dorsal and ventral sides of the lithic elements (n=5) from MMEP6 Grid 3 (PGS March 2021).*

Figure 20. *Establishing MMEP6 Grid 4 to record density distribution of lithic elements (PGS March 2021).*

Figure 21. *Dorsal and ventral sides of the lithic elements (n=5) from MMEP6 Grid 4 (PGS March 2021).*

Figure 22. *Surface MSA lithics from MMEP6. Note the undecorated potsherds. Scale in 1 cm increments (PGS 2019: 75).*

7.3 MMEP47 GPS Coordinates: S 23.94800 E 28.91889

7.3.1 The 2019 HIA documentation

Significance: The site was deemed to be of **Medium Significance or Generally Protected B (GP. B**) (PGS 2019: 159).

7.3.2 2021 Documentation of the MMEP47 assemblage

The site east of Mamogashwa Hill (Fig. 23) occurs in proximity to two other stone tool surface scatters, namely MMEP48 (not mitigated) and MMEP49. MME 47 exhibits a fairly dense scatter of MSA lithics. Blades, flakes and debitage on quartz, quartzite and CCS were noted. The lithics at MMEP47 occur on a relatively level area in what is apparently a secondary depositional context within a layer of small quartz pebbles in an area of approximately 20 m x 20 m.

It is likely that the areas currently covered by MMEP47, MMEP48 and MMEP49 were part of a former larger MSA site or an extensive concentration of lithics (PGS 2019). Erosion likely removed sections of the site.

Figure 23. *General views and detail of MMEP47 (PGS March 2021).*

At MMEP47 three 1 m x 1 m grids (Figs 23 and 24) were placed on selected areas to determine the relative density of lithics. The grids were placed on the areas that exhibited the highest density of lithic material. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of low (<10), medium (10–20) and high (>20). No high-density concentrations of stone tools were evident. The results were as follows:

Grid 1: n=7 (Low density <10) (Figs 24 to 25)

Grid 2: n= 3 (Low density <10) (Figs 26 to 27)

Grid 3: n=8 (Low density <10) (Figs 28 to 29)

Figure 24. *Establishing MMEP47 Grid 1 to record density distribution of lithic elements (PGS March 2021).*

Figure 25. *Dorsal and ventral sides of the lithic elements (n=7) from MMEP47 Grid 1 (PGS March 2021).*

Figure 26. *Establishing MMEP47 Grid 2 to record density distribution of lithic (PGS March 2021).*

Figure 27. *Dorsal and ventral sides of the lithic elements (n=3) from MMEP47 Grid 2 (PGS March 2021).*

Figure 28. *Establishing MMEP47 Grid 3 to record density distribution of lithic elements (PGS March 2021).*

Figure 29. *Dorsal and ventral sides of the lithic elements (n=8) from MMEP47 Grid 3 (PGS March 2021). (PGS March 2021).*

7.4 MMEP49 GPS Coordinates: S 23.94891 E 28.92029

7.4.1 The 2019 HIA documentation

Significance: The site was deemed to be of **Medium Significance or Generally Protected B (GP. B**) (PGS 2019: 162).

7.4.2 Documentation of the MMEP49 assemblage

At MMEP49 MSA lithics were present on the surface of a relatively level section east of Mamogashwa Hill at a small rock outcrop and a small water hole (Fig. 34). MMP49 is close to sites MMEP47 and MMEP48. All three sites probably resulted from erosional processes. Sites MMEP6, MMEP48 and MMEP49s may be remnants of what formerly had been a much larger site and that the extensive erosion removed large sections thereof. A relatively high density of MSA stone tool types that include blades, flakes and debitage made on quartz, quartzite and CCS occur within a coarse sand and pebble layer in an area of around 20 m x 20 m.

Figure 30. *General view of MMEP49 (PGS 2021:*

Figure 31. *Detail of lithics on a coarse sand and pebble surface at MMEP49 (PGS 2019: 163).*

At MMEP49 three 1 m x 1 m grids (Figs 30 to 37) were placed on selected areas to determine the relative density of lithics. The grids were placed on the areas that exhibited the highest density of lithic material. By plotting the counts of all lithic elements, relative density per square metre was established and rated on a scale of low (<10), medium (10–20) and high (>20). No high-density concentrations of stone tools were evident. The results were as follows:

Grid 1: n=6 (Low density <10) (Figs 31 to 32)
Grid 2: n= 3 (Low density <10) (Figs 33 to 34)
Grid 3: n=12 (Medium density 10-20) (Figs 35 to 36)

Figure 32. *Establishing MMEP49 Grid 1 to record density distribution of lithic elements (PGS March 2021).*

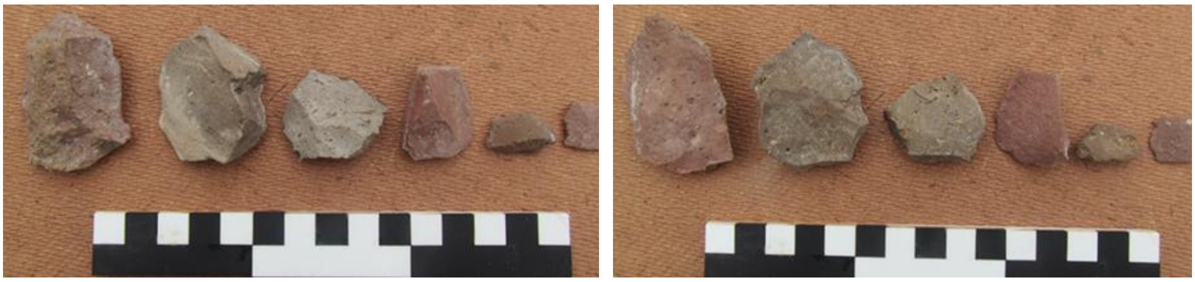

Figure 33. *Dorsal and ventral sides of the lithic elements (n=6) from MMEP49 Grid 1 (PGS March 2021).*

Figure 34. *Establishing MMEP49 Grid 2 to record density distribution of lithic elements. Note the water feature (PGS March 2021).*

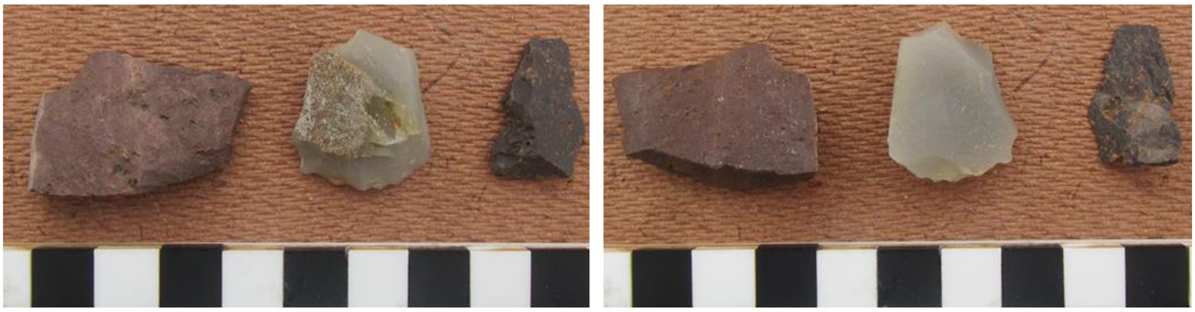

Figure 35. *Lithic elements (n=3) from MMEP49 Grid 2 (PGS March 2021).).*

Figure 36. *Establishing MMEP49 Grid 3 to record density distribution of lithic elements (PGS March 2021).*

Figure 37. *Dorsal and ventral sides of the lithic elements (n=11) from MMEP49 Grid 1 (PGS March 2021).*

8 Typology of the MMEP tool types

(Based on Deacon 1984a, 1984b; Lombard et al. 2012)

Iconic and characteristic lithic types and technological attributes are used to construct a typology for a particular assemblage. Typology is the science of classification whereby stones tools are arranged in orderly groups (Schick & Toth 1993: 96). Even lithic clusters with low densities can produce valuable data (Tainter 1979). Whereas areas that featured concentrations of artefacts were targeted for documentation, only low to medium stone tool densities were apparent at all four of the MMEP MSA localities that were mitigated through non-invasive documentation and analyses. In the following section the various stone tool types recorded at MMEP are discussed with reference to the production of particular tool types based on their morphology and likely function. Note that images of tool types photographed during the density surveys of the lithics at the MMEP sites are also provided in the section on the documentation thereof (Figs 3 to 37).

8.1 Debitage

Two main products result when a suitable source of stone is struck with a stone hammer: the rock/stone from which fragments are struck, termed the core; and the fragments produced by the impact, namely the flakes or flaked blanks. The point of impact is the striking platform. Stones that have been flaked by humans exhibit a breakage pattern called conchoidal fracture. These are ripple marks on the inner surface that radiates in progressively larger arcs from the point of impact (Schick & Toth 1993). The side that shows the force of impact is the ventral surface. The first, or primary, flakes retain some cortex. The cortex of a core or flake is the weathered, outer surface of the rock. Depending on the type of core and also the technique that the tool maker uses, subsequent flakes retain cortex or partial cortex and/or dorsal scares on the dorsal surface.

Schick and Toth (1993: 118) define technique as the physical forces applied to the stones, whereas methods/strategies are generated in the mind of the tool maker. Both became more sophisticated over time, that is from the earliest tools produced by humans during the ESA, and the increased sophistication and complexity that mark the MSA. There is a radical and abrupt change in the archaeological record around 40 000 ya at the onset of the LSA, with further refinement and an exponential range of tool types (Schick & Toth 1993).

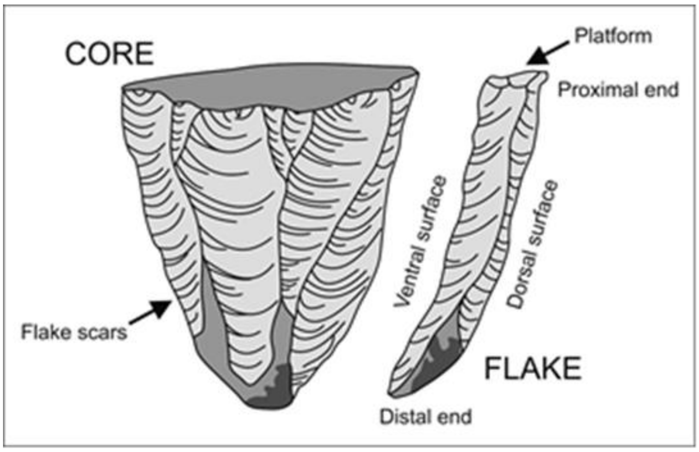

Figure 38. *Some basic terms used to describe the attributes of a core and flake (AGE2601/2018).*

Stone tool production is subtractive. Different stages of modification of raw materials yield debitage and flaked material. Shaping of the core produced discards in the form of small chips and unusable flakes. Debris from the production of flaked blanks, the reworking of primary blanks into tools and also the resharpening of tools during maintenance, generated waste and account for a large proportion of the lithics in any assemblage. Further shaping of flaked blanks to produce task-specific tools produced small flakes and chips of debitage that were usually discarded. The blank form can be retouched along one or more edges for the working part of a tool. The final tool forms shaped through formal retouch are classified as formal tool types.

The MMEP surface collections are in disturbed contexts, with low levels of lithic elements such as chips, chunks and debris from stone tool manufacture since these are generally not well-presented at open-air localities. A surface assemblage is also not likely to retain the same quantities of discards since surface material is often reused by later populations. The density mapping are statistically insignificant Fragments register behaviour as much as complete tools (Shott 2000). At the MMEP localities some debitage from stone tool production and a quartzite hammer stone from MMEP5 (Fig. 11), used in knapping, suggest localised manufacture of at least some of the lithics.

8.2 Cores

Several cores were evident on the exposed surfaces of the MMEP localities. Rock types selected for cores include red jaspilite, quartzite and felsite (Figs 41 to 42). At least three negative flake removal scars are required to classify a block of material as a core (see Fig. 39). Pieces that exhibit only one or two negative flake scars are therefore classified as chunks and not cores. Prepared or Levallois cores are diagnostic MSA core types. Through this technique a core is shaped by the systematic removal of flakes from a pebble or a chunk of rock in order to produce a final product of one flake/blade or multiple primary flakes. With the prepared technique cores were shaped through some preliminary flaking to produce pre-determined shaped blanks that were subsequently used to manufacture different tool types.

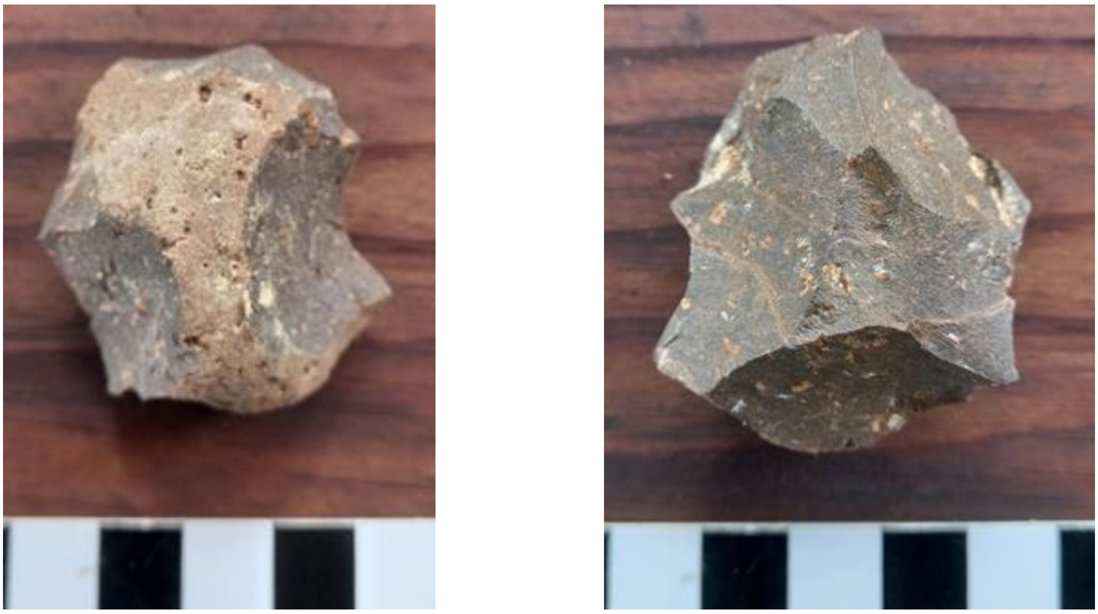

Figure 39. *Felsite cortical multi-platform core from MMEP6 (PGS March 2021).*

8.3 Flaked products

At the MMEP localities several blade forms and broken blades, endstruck and sidestruck flakes and broken flakes were recorded. MSA assemblages often contain relative high numbers of sidestruck flakes. The comparatively low numbers of lithics from different classes of tool types that could be recorded at the MMEP sites are, however, statistically insignificant. Flakes, bladelets and blades are the main products of any reduction process. Flaked blanks with a sharp cutting edge were frequently used without further modification of retouch. Variability in flake morphology results from raw material differences, functional requirements and use life (Andrefsky 2005).

8.3.1 Blades

Flakes with parallel sides are termed flake blades. Several blade forms and broken blades, both cortical and non-cortical, form part of the MMEP collections (Figs 40 to 42). Raw materials that featured in the manufacture of the lithics are CCS, quartz, quartzite and felsite. Some exhibit utilization. The origins and significance of laminar technology are complex. Blade technology was invented in multiple places and times (Wilkins & Chazan 2012). Technological changes, including prepared core reduction strategies that delivered multiple flake and blade blanks from a core, are common elements in MSA assemblages (Wadley 2016). Blades were also used in the LSA, but to a lesser extent. These technological and behavioural shifts roughly correlate with the appearance of *Homo* species, and also increases in cranial capacity (Ruff et al. 1997; Rightmire 2001; Willoughby 2008; Wilkins & Chazan 2012).

Blade manufacture with hard and with soft hammer percussion is mainly a characteristic of the MSA (Soriano et al. 2007). Prepared cores yielded pre-determined shaped blanks which were subsequently used to manufacture different tool types. Long narrow punch-struck blade flakes can occur in a range of sizes. Blades usually show signs of utilization but were also used as blanks to produce formal tools. Knives are blades that were shaped through retouch to produce a faceted cutting edge. Blades with utilization and/or retouch are typological elements of the MSA.

Figure 40. *Blade with utilization made on felsite from MMEP47 (PGS March 2021).*

Figure 41. *Two blades on felsite from MMEP5 Grid 1 and Grid 3 respectively 1 (PGS March 2021).*

Figure 42. *Dorsal and ventral views of three blades with emphasis on the distal tip from MMEP5 (PGS March 2021).*

8.4 Formal tools

A high frequency of formal tool types and production debris generally demonstrate production on site or that the tools have been used for subsistence-related tasks. The detached blanks are shaped through secondary retouch into specialized tool types required for particular tasks.

Emblematic MSA tool types were recorded at all the MMEP localities. These include several unifacial points, convergent flakes, awls and scrapers. Points and convergent flakes are typical MSA products of prepared Levallois, centripetal and radial cores. These core types delivered specific triangular or convergent flakes that served as blanks. The flaked blanks could be used without any further trimming, but also shaped into specialized tool types such as pressure-flaked unifacial or bifacial point (Figs 44 and 45).

8.4.1 Convergent morphologies

MSA convergent flakes form part of the MMEP assemblages (Figs 11, 43 to 46), but are not common. Convergent morphologies and point production are some of the most characteristic technologies of the southern African MSA. The MMEP sites yielded a variety of points (Figs 43 to 45). In a recent comparative study on point production in MIS 5 assemblages, Douze et al. (2020) argue that technological and use-wear patterns reflect regionally-specific features. Although varied, MSA points do conform to a morphological template of a convergent triangular shape where the lateral edges join in a distal tip (Mackay et al. 2010). This shape has various functional applications, with two long cutting edges and a sharp tip that can function in perforation.

Figure 43. *Dorsal and ventral views of a quartzite point from surface MMEP5 and the other specimen from the surface of MMEP47 is on felsite (PGS March 2021).*

Figure 44. *Dorsal and ventral views of unifacial points. The brown felsite point was recorded in Grid 1 MMEP5 and the red felsite specimen in Grid 2 MMEP5 (PGS March 2021).*

Figure 45. *Dorsal and ventral views of both from MMEP49. Note weathering on the left specimen (PGS March 2021).*

Figure 46. *MSA convergent flake with utilization on felsite from MMEP6 (PGS March 2021).*

8.4.2 Perforating tool types and scraper combinations

Several examples of tools with focus on the distal tip, also termed awls, were present at the MMEP localities (Figs 47 to 48). A pointed tip was frequently obtained through the removal of a burin spall on one edge and invasive retouch on the other. Perforators with a similar short projection from a MSA open-air assemblage in Botswana have been classified as a sub-class of awls (Robbins 1989). This tool type is task-specific and were presumably used for a variety of tasks. Common ethnographic applications for awls and borers include their use as piercers in the manufacture of skin clothing, leather hunting and gathering bags, reed matting and to make holes in ornamental objects of skin, wood, bone and shell.

Figure 47. *Dorsal and ventral views of two blades with emphasis on the distal tip from MMEP5 (PGS March 2021).*

Figure 48. *Dorsal and ventral views of two perforating tool types with emphasis on the distal tip from MMEP6 (PGS March 2021).*

8.4.3 Scrapers and scraper-awls

Scrapers are integral to Stone Age lithic assemblages worldwide and from virtually all prehistoric periods. Their function is, in the main, ascribed to hide working based on ethnography (Webley 1990; Deacon & Deacon 1999). In southern Africa endscrapers in particular are associated with scraping and processing skins (Stow 1910; Silberbauer 1981). These tool types usually have a convex edge formed by retouch and utilization. The retouch is generally at an angle of 30° to 90°. Often MSA scraper forms with a convex edge also exhibit a pointed, awl-like tip (Figs 49 to 50). During the lithic density documentation various scrapers were noted. Felsite, CCS, quartzite and quarts were used in their manufacture.

Figure 49. *Dorsal and ventral views of scraper-awl on quartzite at MMEP5 (PGS March 2021).*

Figure 50. *Dorsal and ventral views of scraper-awl on red felsite from Grid 1 MMEP5 (PGS March 2021). Scraper-awls from Swartkop Hill in the interior of Namaqualand tip (van der Ryst & Küsel 2013). Note similarity between the two examples.*

A LSA endstruck scraper with cortical remains made on CCS was found at MMEP49 (Fig. 51). This artefact that originates from a much more recent context demonstrates the often disturbed nature of open-air localities. Presumably this tool type was used in the production of wooden hafts for composite tools, other wood- and bone working activities, and for the processing of skins, medicinal and plant foods. Bone and stone tools are used in the dehairing, fleshing and softening of hide working (Christidou & Legrand 2003; van der Ryst 2006). The Kua men of the Kalahari say that "[t]he work we most enjoy is the scraping of the skins" (Valiente-Noailles 1993: 59). Marshall (1976) observed that during hide-working the conversation of Ju/'hoansi men is all about the hunt, which is a topic they never tire of. There is much inter-site and intra-site variability in scraper morphology, and technological and functional variations are particularly evident in LSA assemblages (Guillemard & Porraz 2019).

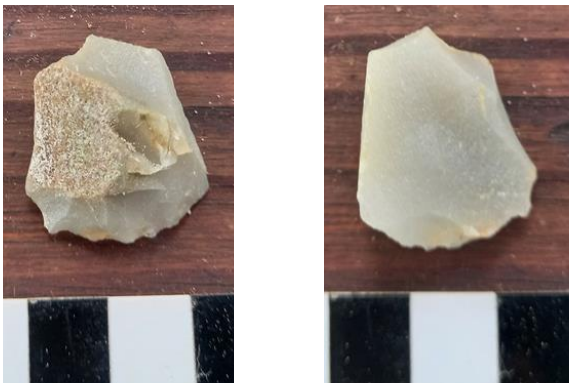

Figure 51. *Small endscraper made on CCS, MMEP 49 Grid 2 (PGS March 2021).*

8.5 An ESA handaxe

A handaxe made on a large felsite cobble was also found during the March 2021 survey (Fig. 52). The overlay of intermittent visits by nomadic groups from various periods over the long timespan for the South African Stone Age succession is to be expected at an open-air locality. The handaxe is the most diagnostic tool type of the Acheulean Earlier Stone Age (ESA). Large Cutting Tools (LCT's) made their appearance nearly synchronous with that of *Homo ergaster/erectus* at 1.8 mya (McNabb et al. 2004: 653). The iconic handaxe has been produced in many parts of the world (White et al. 2018). The handaxe was a versatile tool and probably used for many different functions (Langejans 2012).

This lithic type has a wide geographic spread and were manufactured for more than a million years. While there is no real standardization in the final shape of handaxes, this tool type does suggest a shared concept for an overall convergent shape (McNabb et al. 2004; Li et al. 2016). Handaxes can be remarkably symmetrical, showing bilateral symmetry in both their outline and their cross section, and exhibit very even regular edges while maintaining a sharp, cutting edge (Schick & Toth 1993). In South Africa smaller handaxes occur towards the end of the (ESA) and the transitional stages between the ESA and the MSA.

Figure 52. *ESA Acheulean handaxe made on a large felsite cobble (PGS March 2021).*

9 Contexts of the MMEP sites

The southern African MSA, which lasted almost half a million years from >250 000 to around 40/20 000 years ago (see Annexure A), is associated with early modern humans with complex cognition, novel behaviours and transformative technologies. Dates proposed for the transitional period between the ESA and MSA are based on a series of dates obtained through various dating methods, palaeoclimatic inferences as well as lithic technologies and diagnostic tool types as artefactual markers of a particular period (Porat et al. 2010; Herries 2011; Walker et al. 2014). From around 200 000 there is clear evidence for anatomically modern *Homo sapiens* (McBrearty & Brooks 2000; Willoughby 2008). The use of compound adhesives and pigments, projectile hunting, the hafting of lithics to handles and the retouch of lithic points are some of the technological innovations that are particular to the MSA. The MSA in southern Africa is therefore an important phase being marked by anatomically modern human development, complex cognition and the development of sophisticated technologies, and regional and cultural identities (Porraz et al. 2013; Wadley 2013a; Chazan 2020). Cognitive complexity implies a capacity for abstract thought, innovative technologies, goal-directed actions, flexibility in problem-solving as well as planning over long distances or time (Wadley 2013a, 2015, 2016).

The interpretation of any material record and the processes of deposition can be daunting (Shott 1998). To understand toolmaking and the ideas or intentions behind the final product, we have to consider variables such as the raw material that the toolmaker chose to work with, the complexity and extent of the deliberate shaping or retouch, and the morphology of the final product (Schick & Toth 1993, 2006). The presence of a tool, or fragments, in an assemblage not only records use or collection for whatever reason but register behaviour (Shott 2000). Archaeologists do not reconstruct the past, which is gone. Instead, we infer its nature from the material record that we directly observe in the present (Shott 1998). In fact, the majority of archaeological materials comprise ephemeral scatters of stone tools and debris. It is often difficult to assign a value to ephemeral occupation sites or tools from eroded or deflated contexts recorded during an HIA or AIA such as the MMEP localities.

Landscapes are the geographical context in which prehistoric socio-economic systems functioned and were transformed by socioecological processes (Barton et al. 2004). Some archaeologists even argue that the concept of a site should be replaced by one of an archaeological landscape. In the archaeology of hunter-gatherers we are dealing with only a small fraction of the complex patterns of mobility and landscape use. Surface stone artefacts from open-air localities such as the MMEP sites are likely to be short-term remains of the activities of hunters and gatherers. Such localities can, however, offer some insights into the behaviour of hunters and gatherers, patterns of settlement, resource procurement, and land use (Tainter 1979; Zvelebil et al. 1992; Dietl et al. 2005; Hardaker 2011). The impact of geogenic, biogenic and anthropogenic factors on site formation processes, as well as vertical and horizontal movements in the deposit, are essential to establish spatial integrity and sequential occupations (Henry et al. 2004; Barton & Riel-Salvatore 2014). The overlay of intermittent visits by nomadic groups from various archaeological periods over the long span of the South African Stone Age succession is, moreover, to be expected at an open-air locality such as at MMEP. Open-air scatters or occupation levels often present as a deflated horizon where the soils have been leached resulting in a collection of lithics from separate visits or even Stone Age periods.

The MMEP lithics were recorded on current surfaces and from erosional contexts. Various lines of inferences can be used for the deposition. Whereas some of lithics may still lie on the original surfaces, others are clearly diffused. The lithics of the MMEP localities occur within calcretes or in a pebble layer among pronounced erosion gullies and erosion channels. Various factors contribute to gully erosion and hillslopes steeper than 4.5° are particularly vulnerable (Mararakanye & Sumner 2017). Many post-depositional site processes can account for the accumulation of the lithics. It is most likely that the surface areas on which the lithics occur are remnants of formerly larger concentrations, sections of which were eroded away by gully and donga formation and exposed through soil loss. Alternatively, but less likely, the lithics could have been translocated from their original deposition at higher-lying sites by water and other erosional mechanisms. The presence of calcrete coating on some examples and also mechanical weathering, reflect some post-depositional translocation.

ESA, MSA and LSA lithic assemblages often occur in calcrete and other cemented deposits around open water sources such as pans and springs. A water source is indeed located close to Sites MMEP47 to MMEP49 (Fig. 34). If this were also a water resource during the MSA, it may account for the extensive (but sparse) spread of MSA lithics across the immediate area. Calcium carbonate cemented crusts are often referred to as calcretes. Calcretes can develop in a variety of climatic and geomorphic environments and in different landscape settings (Nash et al. 1994; Nash & McLaren 2003; Hutson & McCain 2008; Pollarolo et al. 2010). The soil profiles of the Waterberg region include strongly cemented calcretes (Waterberg – NI 43-101 Technical Report 2016). A project on the depositional history of the Nyl/Mogalakwena River floodplain interrogates various models for the landscape formation (Colarossi 2013). However, the reconstruction of the palaeo-environmental conditions in the interior of South Africa during the Quaternary and also geoarchaeological studies that can inform on formation processes and the primary or secondary depositional context of the archaeological assemblages at MMEP are clearly beyond the scope of this report.

The assessment of site integrity at open-air sites is consequently complex. Open sites do not preserve all aspects of the innovations from this period. The documentation of assemblages from different sections of the study area allows an investigation of density patterning and the techno-typological attributes of the documented lithics. The low densities of artefacts and knapping debris per square meter at the MMEP localities suggest that the area was likely intermittently visited by MSA communities roaming the landscape to extract subsistence materials for food, with expedient knapping of suitable stone material to produce useable flakes and also some formal tool types required for specific activities.

The data from the two surveys and the analyses of lithics from four areas are used to discuss the attributes of the lithics and to make some inferences. The typological classification uses terminology commonly applied to southern African MSA lithic analyses (Porraz et al. 2013). Tool industries are defined by the presence or absence of specific and iconic or emblematic tool types or classes, also known as the type specimen (Schick & Toth 1993). The most significant tool types observed during the survey and the in situ documentation of the lithics are a range of typical MSA points, blades with retouch and/or utilization and also several awl types

The toolkits of mobile groups with low carrying capacity are generally multifunctional. Lithic studies support such multifunctional applications (Lombard et al. 2004; Andrefsky 2005). The functional attributes of a tool, such as several working edges, define use (and typology), and not always the overall morphology (Shott 1986; Andrefsky 2005; Macdonald & Wilkins 2010). Yet the functions of the various classes of artefacts within each period are often inferred by their morphology. Lithic tool names typically imply use for a specific task, for example a scraper or an awl/perforator. A term such as scraper refers to the morphological shape as well as to the function of the artefact. Such functional interpretations are indeed often correct, but the form of an artefact does not necessarily match its inferred function. Different shapes and sizes of tools, for instance scrapers, often result from use and the resharpening of implements rather than different mental templates. The most significant tool types observed during the survey and the in situ documentation of the lithics are a range of typical MSA points, blades with retouch and/or utilization and also several awl types. Convergent morphologies and point production are some of the most characteristic technologies of the southern African MSA. Formal tools that were intentionally shaped through retouch were also present. Some cores, a hammer stone, unretouched primary flakes that retain cortex and secondary flaked blanks suggest activities such as the procuring and processing of foods, other subsistence-related activities and the manufacture of tools.

Current research suggests the possible hafting of stone artefacts to tip hunting weapons in the MSA. The MSA is often seen as decisive moment where hafted tools (i.e. points) replaced handheld tools of the ESA (i.e. bifaces) (Brooks et al. 2006; Wilkins et al. 2012; Dusseldorp et al. 2013; Backwell et al. 2018; Douze et al. 2020). The identification of adhesives for hafting may have important cognitive significance (e.g. Lombard 2005; Wadley et al. 2009). Tool types from MMEP suitable for hafting are convergent flakes and points. In a recent comparative study on point production in MIS 5[4] assemblages, Douze et al. (2020) argue that technological and use-wear patterns reflect regionally-specific features. Although varied, MSA points do conform to a morphological template of a convergent triangular shape where the lateral edges join in a distal tip. This shape has various functional applications, with two long cutting edges and a sharp tip that can function in perforation. Two main concepts were applied during the MSA to obtain this morphology: bifacial or unifacial shaping of undefined/non-pointed predetermined flakes into pointed forms (typological points); and the production of triangular/convergent flakes (technological points) from a prepared core surface (McBrearty & Brooks 2000; Herries 2011; de la Peña et al. 2019; Douze et al. 2020). These blanks could be further shaped through retouch, or used without any further trimming. The variability in point technologies suggests different technical solutions to obtain convergent triangular flakes (Douze et al. 2020).

The MSA at the MMEP localities is deemed undiagnostic since the documented assemblages are too small to assign to a particular MSA lithic industry. Wadley (2016) suggests that more open sites in northern South Africa should be investigated to see how their assemblages compare with cave and rock shelter sites. Important MSA excavated sites from the general region were briefly reviewed in Section 6 of this report to provide a background and context for the lithics at the four MMEP localities that were selected for mitigation. The MSA in southern Africa comprises various industries and regional expressions such as the Pietersburg Industry that have been documented for the northern regions. The oldest MSA sites seem to occur inland (Wadley 2015; de la Peña et al. 2019). Most of the excavated MSA sites share technological characteristics ascribed to the Pietersburg Industry. The Pietersburg Industry, as presently defined, may result from the availability of blocks of fine-grained locally available rock types. The large size of the cores allowed the knapping of large, elongated lithics that are a feature of the Pietersburg. However, considerable variation is found in the southern African MSA sites, both across space and through time (Wadley 2016). This can to some extent be ascribed to the availability of fine-grained rock types suitable for tool manufacture.

The raw materials selected for the MMEP lithic assemblages include felsites, coarse-grained and fine-grained quartzite, siliceous rocks (CCS), and limited examples on quartz. All of these could be potentially procured from the immediate surroundings. The lithic assemblage is dominated by felsitic material. This may reflect some selectivity for particular rock types. The 2150 Ma Rooiberg Felsite Group forms part of the Transvaal Sequence (Von Gruenewaldt 1968; Von Gruenewaldt et al. 1985; Eriksson et al. 1994; Eriksson et al. 1996). Felsitic materials occur in a range of colours in the Rooiberg felsites and the related altered or metamorphosed fine-grained felsites (also known as leptites) (Von Gruenewaldt 1968). Felsitic materials were commonly used for MSA lithics in areas with good sources of this toolstone (van der Ryst 2006; Wadley et al. 2016). Preliminary knapping often occurred at sources and outcrops of preferential material since rock is heavy and transport distance had to be

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[4] Marine Isotope Stages (MIS) are the chronological listing of alternating cold and warm periods of the global oxygen isotope record that reflects palaeoclimatic changes. The marine isotope variations are numbered from the top down with warm interglacial stages having odd numbers and cold glacial stages even numbers. MIS 1 is the Holocene. The global MIS record provides a framework to structure chronology. The MIS timescale is now widely used in archaeology for the reconstruction of climate and to express relative dates of archaeological occurrences during the Quaternary period (Barham & Mitchell 2008; Mitchell 2008).

considered.

While the MSA lithics are associated with the Pleistocene, not enough lithics were recorded at the MMEP localities during the two surveys to make an informed decision of a more precise age for the local MSA. A representative suite of lithics that contain iconic tool classes, and a satisfactory high level of site integrity are required to relatively date an assemblage. The dating of open-air sites is problematic because such localities represent a palimpsest of activities and visits over time, and diagnostic formal tool types that act as classic cultural markers may be absent or rare (Porraz et al. 2008; Porraz et al. 2015; Porraz et al. 2018).

10 Recommendations and mitigation measures

The significance of the impact of the development during a pre-mitigation Medium Significance is supported by the post-mitigation Medium Significance based on the data collected during the 2021 non-invasive documentation and subsequent analyses. A fairly low-scale utilization of resources during the MSA is reflected by the relatively low numbers and densities of lithics, and the somewhat limited range of formal tool types recorded on the surface at localities MMEP5, MMEP6, MMEP47 and MMEP49. While the 2019 and 2021 surveys and documentation reflected the distribution of artefacts on the surface, the recorded densities were unfortunately too low to allow any inferences on spatial patterning. The lithics were mostly present on calcrete or pebble surfaces. No subsurface lithics were observed in the walls of the eroded gullies.

SAHRA (2007: 4) defines mitigation as '[t]he act or effort by a qualified heritage specialist appointed by a developer to lessen the impact of a development on heritage resources within or near the development footprint'. The author of this report is confident that the lithic occurrences of the property under review were adequately documented and assessed during the 2019 PGS HIA and the subsequent survey and documentation during March 2021 and lastly, the analyses and report by the Stone Age specialist.

No further mitigation actions are required. 'As per our archaeology permit policy if the assessment indicates that no further assessment will be required the decision to allow for destruction will be part of the SAHRA comment on the case. There will be no need to a separate destruction permit application' (Phillip Hine SAHRA Pers. comm. 11 May 2021).

It is not expected that these localities will yield subsurface lithics, apart from lithic elements that deflated downwards. However, in the event that construction activities do reveal subsurface lithics, the Change Find Procedure (CFP) for Mogalakwena must be implemented and the heritage authorities informed.

11 Conclusion

Anthropogenic activities and industrial developments have a negative impact on heritage resources (Durand 2007). Research on localities that are to be destroyed following on infrastructural development is of immense importance as these are non-renewable heritage resources. It is again emphasized that surface collections represent various episodes of utilization, accounting for much of the observed variability in morphology and technology. Large-scale variability and behavioural flexibility are observed during the southern African MSA (Kandel et al. 2016). There is in particular much diversity in the morphology of tools, stone tool typologies and stone-working techniques throughout the MSA, which suggests regional diversifications (Mitchell 2002a, 2008; Wadley 2005c; van der Ryst & Kruger 2008; Wilkins et al. 2012; Lombard et al. 2012; Van der Ryst & Küsel 2013; Porraz et al. 2015; Wadley et al. 2016; de la Peña et al. 2019; Douze et al. 2020; Val et al. in Press 2021). Data recorded through HIA and Phase 2 studies contribute significantly to our knowledge of land-use patterns and variability in subsistence activities and stone tool manufacture within a specific region.

Open-air localities are often under-researched. The above discussion demonstrates the importance of documenting and studying surface tools in open-air contexts, identify their affiliation to a specific period, and assess the densities in which the artefacts occur. The information gathered add to the data base on open-air Stone Age localities for the Limpopo region and can inform on the use of a particular landscape.

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13 Annexure A: The southern African chronological sequence

The following table provides an overview of the southern African chronological sequence, the main attributes associated with a particular period, and cultural groups associated with each of the periods.

The southern African chronological sequence		
Cultural period and approximate ages	**Cultural groups**	**Technological attributes and tool types**
Earlier Stone Age (ESA) >2 m—>200 000 ya[5]	Early hominins Australopithecines *Homo habilis* *Homo erectus* archaic *Homo sapiens*	Large cutting tools (LCTs), scrapers and flaked forms. Some use of flaked bone as tools.
Middle Stone Age (MSA) <300 000 —>20 000 ya	Archaic and fully modern *Homo sapiens*	A reduction in tool size. Blades, convergent points and awls made on prepared core types to produce uniform tool forms, also scrapers and other tool types. Flaked products were often further shaped through secondary retouch to produce a range of formal tool types. Decorative items, body ornaments and ochre use become apparent. Rare engravings and rock art.
Later Stone Age (LSA) <40/20 000 ya up to historical times	*Homo sapiens* San hunter-gatherers Khoekhoe herders	An extended range of microlithic tool types, often used as inserts for bow-and-arrow hunting. Characteristic tools include scrapers, borers, and arrow heads. Ostrich eggshell (OES) beads and flasks — sometimes decorated— are prolific. Trade/barter items include glass, iron and copper beads, and pigments. Leather working, basketry, bone implements and armatures for arrows are common. Bow-and-arrow hunting and snaring. San and herder ceramics. Domestic animals: sheep, goats, cattle and dogs. Rock art. Polished stone tools and grooved stones used to shape different bone implements.
Early Iron Age (EIA) c. AD 200—c. AD 900	Bantu-speaking African farming	Distinct pottery styles for the various pottery expressions, metal working,

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[5] Ya = years ago

	communities	subsistence agriculture, domestic animals, trade and barter. Upper and lower grinding stones.
Middle Iron Age c. AD 900—c. AD 1300	Bantu-speaking African farming communities	Distinct pottery for the various ethnic groups, metal working, subsistence agriculture, domestic animals, trade and barter.
Late Iron Age (LIA) c. AD 1300 – c. AD 1840 Stone-walled LIA sites: c. AD 1640—c. AD 1840	Bantu-speaking African farming groups and Europeans	Characteristic pottery traditions associated with each of the main divisions, metal working, subsistence agriculture, domestic animals, trade and barter. Upper and lower grinding stones and other stone implements. Farmer rock art. Stone-walled settlements.
Colonial Period c. 1650	Bantu-speaking African farming groups and Europeans	Historical structures, industrial metals, glass, porcelain and ceramics.
Historical Period c. 1850	Various African groups, groups of mixed origin and Europeans	Historical structures, industrial metals, glass, porcelain and ceramics.

The following section provides a synthesis of the cultural succession of settlements within the southern African archaeological context.

13.1.1 Stone Age

Archaeological traces in the form of mostly stone tools suggest a widespread presence for tool-producing Plio-Pleistocene hominins in southern Africa. The South African Stone Age sequence is chronologically divided into the Earlier Stone Age (ESA), the Middle Stone Age (MSA) and the Later Stone Age (LSA) based on the concept of techno- or industrial complexes. Each of the subdivisions is formed by a group of industries where the assemblages share attributes or common traditions (Deacon & Deacon 1999; Lombard et al. 2012).

The australopithecines were gradually displaced by *Homo habilis*, a genus that evolved into the more advanced *Homo ergaster/erectus* by 1.8 million years BP. The large stone cutting tools (LCTs) associated with these hominins form part of the Oldowan and Acheulean industries of the ESA. Most ESA localities with stone tools in South Africa are associated with the hominin species known as *Homo erectus*, and the more recent ESA assemblages with archaic *Homo sapiens* (Barham & Mitchell 2008).

By >250 000 years BP, the large cleavers and handaxes of the ESA were discontinued and replaced by a larger variety of smaller tools and weapons of diverse shapes and sizes and made by using different techniques. The MSA typologies following on the ESA represent greater specialization in the production of stone tools, in particular flake, blade and scraper tools and also in a more extended range of specialized, formal lithic tool types. These changes in technology mark the beginning of the MSA.

The MSA is known for typically prepared centripetal cores that delivered specific convergent/pointed flakes and a range of flake blades (Soriano et al. 2007). Flaked products often retain the characteristic faceted striking platform that derives from this technique (see Fig. 11). Several other core types were also used to produce blank forms. Many of these were shaped by secondary trimming to produce a range of formal tool types. This period is moreover characterized by regional lithic variability, evidence for symbolic signalling, polished bone tools, portable art and decorative items.

The main developments during the MSA are cognitive, cultural and physical modernity (Wadley 2013a, 2013b, 2015, 2016; Chazan 2020). The MSA, which lasted almost half a million years, is associated with early modern humans with complex cognition, novel behaviours and transformative technologies. During the MSA early humans still settled in the open near water sources but also in caves and shelter localities. The MSA marks the transition from the more archaic *Homo* species to anatomically modern humans, *Homo sapiens sapiens* (Jurmain et al. 2013).

It is now generally accepted that the MSA was fully replaced by a mostly microlithic LSA marked by a series of new technological developments and cultural innovations (Wadley 2013a, 2013b). The LSA is marked by a series of technological innovations, social transformations and also noticeable demographic changes (Mitchell 2002a). 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 based on a series of dates obtained through diverse dating methods, palaeoclimatic inferences as well as lithic technologies and diagnostic tool types as artefactual markers of a particular period.

The major changes comprise the replacement of MSA lithic technologies by LSA microlithic stone-working traditions and more widespread signs of symbolic and ritual activity in the form of art and decorative items, specifically objects made for personal adornment, such as pendants and the ubiquitous ostrich (*Struthio camelus*) eggshell (OES) beads (Mitchell 2002a). During the LSA small (microlithic) tools, bone tools and weapon armatures and a range of decorative items as well as rock art were produced.

Hunter-gatherer societies (and the later San) relied to a large extent on bow-and-arrow hunting with poisoned tips, and also snaring. Veld foods and medicinal plants were gathered. Ceramics were used and/or produced by hunter-gatherers and Khoekhoe herders towards the terminal phases of the LSA over a period of around 2000 years. Many of these stone tools and other material cultural items were still manufactured and used when the first Europeans settled in southern Africa in the 17th century AD. Information recorded about the lifestyles of the Khoekhoe herders and the San (Bushmen) at the time of the arrival of Europeans provides some insight into the immediate past history of these indigenous people.

Evidence for Stone Age communities within the broader region comprises the complete sequence of the southern African Stone Age (Mason 1962).

13.1.2 Rock Art

Thousands of painted and engraved sites dating from the LSA have been documented throughout Southern Africa and many more are still being found every year. Paintings and engravings were also executed on loose slabs of stone and some were used as markers for storage pits and in burials. Rock art in the form of paintings, but in particularly the many and diverse categories of engravings on the highveld, is not well represented in the general region (Mason 1968, 1986; RARI Wits Database).

13.1.3 Settlement by African farmers

The migrations into southern Africa and the expansion of Early Iron Age (EIA) African farming societies are apparent from AD 400 onwards. Pioneer Sotho-Tswana and other ethnic groups settled in semi-permanent villages, cultivated a range of crops, raised livestock, made ceramic containers, mined ore and smelted metals and engaged in trade or barter. Our understanding of EIA sites relies heavily on ceramic assemblages as the most archaeologically visible remains of the EIA cultures (Küsel 2011).The Late Iron Age was accompanied by aggregations of large numbers of communities (Huffman 2007; Boeyens 2012) that were often marked by extensive stonewalled settlements, or enclosures demarcated with poles and brushwood.