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Preliminary analysis of forager stone technology at Little Muck Shelter: Pre- to contact levels

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Studies into the Later Stone Age sequence of the Mapungubwe region show several important changes in forager toolkits. Notable shifts include the appearance of ceramics, glass beads and metal, and changes in stone tool preference patterns in some contexts. Few studies have considered stone tool technological shifts from pre-contact into contact periods when farmers arrived in the landscape. By studying forager stone tools, we can examine the manner in which forager groups deployed their own technologies and innovations in contact scenarios to aid and assist with social relations and exchange or trade patterns. In this study, we present the results of a detailed stone tool analyses of an excavation sample from Little Muck Shelter that highlights several continuities and discontinuities over time, from the pre-contact period into the contact phase but also at key moments in the valley's sequence. It demonstrates the role forager technology played in the local economy and how it was used to facilitate social relations.

Keywords: Little Muck Shelter; Later Stone Age; stone tools; interaction; middle Limpopo Valley; Southern Africa.

Introduction

One of the most significant intellectual engagements that have defined the Holocene archaeology of southern Africa is the Kalahari Debate. It is characterised by two schools of thought, members of whom argued competing points: that contemporary San communities were analogous with past Later Stone Age-producing foragers (also called hunter-gatherers) or that they were not because of the influence contact with other groups had on their society (see e.g. Deacon 1984; Denbow & Wilmsen 1986; Sadr 1997; Solway & Lee 1990; Wilmsen 1989). Essentially, this debate pitted continuity against historical trajectories (Kurtz 1994). At its core was disagreement around the autochthony of contemporary San groups and what this meant for their ancestral counterparts. Archaeological investigations have been variously deployed in this debate, by both schools, but the results are mixed; it may be that archaeological change is too constrained to show identity shifts (Denbow 2017). However, contact between various groups brought with it new opportunities, challenges, activities, trade or exchange of goods and social patterns that predictably would have influenced forager decision making. In the middle Limpopo Valley, which includes the confluence of the Limpopo and Shashe Rivers where Botswana, South Africa and Zimbabwe meet, these changes may be more visible in the forager sequence as the nature of contact was more complex than on most other landscapes.

The Limpopo Valley is well known for its Iron Age archaeology. For the most part, this is because Mapungubwe is located in the region, southern Africa's earliest state-level capital dating from AD 1220 to 1300. Most research on this landscape has investigated political, socio-economic developments and landscape patterns, in the region as well as trade networks and their influence (see Goodwin & Lowe 1929; Calabrese 2000). Although farmer groups began settling the extended region from the mid-first millennium, it was only from AD 900 that Zhizo people began living within the valley and introduced long-distance trade into the region. Following this, from AD 1000, K2 users appeared in the valley, taking over trade and political authority and supposedly driving some Zhizo people away from the region. This element is inferred based on the changes in ceramic tradition. The Zhizo people that remained incorporated K2 decorative traits into their ceramic tradition, which is recognised as the Leokwe facies, and fulfilled a lower-status role in society. K2 transitioned into Mapungubwe at AD 1220 when the capital was occupied and used as the Kingdom's central polity, from which the King consulted and pleaded to the ancestors, controlled and accumulated trade wealth, and had political authority over the region

Note: Special Collection: Celebrating Cultural Heritage within National Parks.

(Huffman 2009). The appearance of Mapungubwe represents the earliest state-level society in southern Africa (Huffman 2015). All the while these social activities were taking place in the area, foragers were present. However, there has been far less research conducted to understand their presence in the area. Among such research have been studies focusing on understanding artefact sequences, stone tool technology, use-wear and rock art (e.g. Eastwood & Smith 2005; Forssman 2014a, b; 2015, 2017; Forssman et al. 2018; Forssman & van Zyl 2022; Forssman et al. 2022; Guillemard 2020; Guillemard & Poraz 2019; Hall & Smith 2000; van Doornum 2005, 2007, 2008; Sherwood & Forssman; Walker 1994). Much of this work, though, was spurred on by the initial study carried out by Simon Hall and Benjamin Smith (2000) in the late 1990s.

Ongoing research at Little Muck Shelter (LMS) is a continuation on the archaeological work that has been done in the landscape and represents an increased interest to focus principally on foragers. Little Muck Shelter was chosen because of its proximity to a large Iron Age site, Leokwe Hill, that was previously excavated by Calabrese (2007). The aim of the study at LMS is to establish the impact that arriving farmer groups had on incumbent forager groups. Hall and Smith's (2000) findings showed a series of changes that appeared to be linked to shifts in local farmer society. Moreover, they identified evidence for intense craft production indicated by many stone scrapers. They argued that this intensification of craft production was linked to trade because of the corresponding increase in farmer items. These findings, along with the tight chronology of the site, led to further excavations with the explicit aim of better understanding the site's sequence and the influence farmers had on those living at the shelter. Part of this work, which is the focus of this study, is to conduct a morpho-technological analysis of the stone tool sequence from the earliest occupation until the site's abandonment. The main intentions of the study are to characterise the stone tool assemblage and examine change in production patterns and approaches across the contact divide. The analysis shows a great degree of continuity, suggesting, more broadly, that the appearance of farmer groups and new opportunities did not stimulate technological change. We argue that the lack of change shows that the application of forager stone technologies in an array of activities was possible.

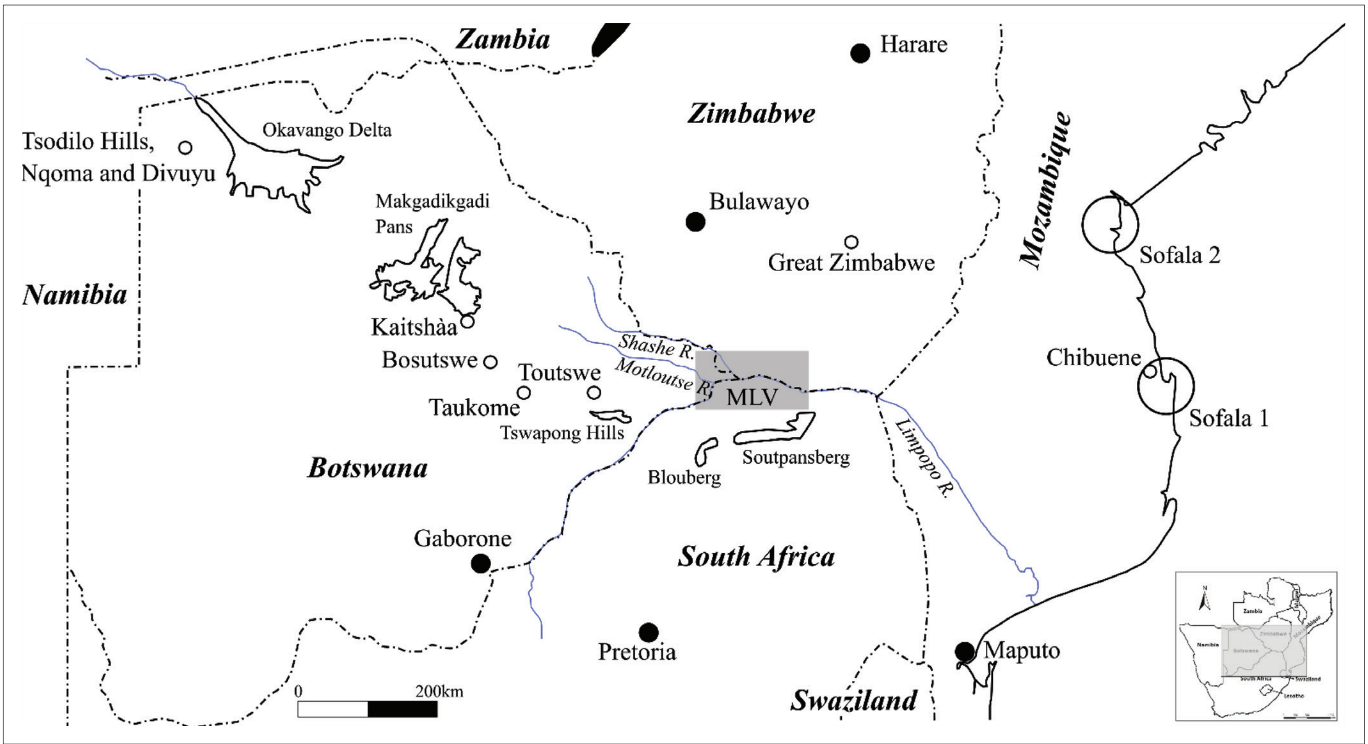
The Later Stone Age of the middle Limpopo Valley

Southern Africa's Later Stone Age (LSA) began between c. 40 000 and 18 000 BP and continued until the arrival of Europeans. From its onset, several changes took place that archaeologists have argued comprise several industries (see Lombard et al. 2012, 2022 for example). There is no need here to review these all, as this has been done elsewhere (e.g. Forssman 2019), but the Wilton and its overlapping subdivisions will be summarised as they are the only industries that relate chronologically to LMS (for a history of Wilton research and a greater discussion, see Mitchell 1997). Wilton assemblages appear around 8000 BP (Lombard et al. 2012, 2022). They were more prominent at Cape sites in South Africa, but many of their features are found at interior sites as well (e.g. Deacon 1984; Mitchell 1997; Lombard et al. 2012, 2022; Wadley 1986, 2000), including in the middle Limpopo Valley (Figure 1). Wilton toolkits typically include a variety of finely worked, standardised formal tools. In mid-Holocene assemblages, these typically include large percentages of scrapers and backed tools, each defined by various forms. Later assemblages exhibit a preference for scrapers (Guillemard 2020; Thorp 1997). This trend of preferring scrapers in later assemblages is not always repeated at other sites, as illustrated by Sadr (2015) from his study of several sites in southern Africa that are date to the first millennium AD. These sites are found throughout the Namibian Coastal Basin, Western Coastal Basin, Southern Coastal Basin, Eastern Coastal Basin, Orange River Basin, Kalahari Drainage Basin, Limpopo River Basin and the Zambezi River Basin. Sadr (2015) found that assemblages at these sites were dominated by backed tools, a trend also recorded by Walker (1980) at Zimbabwe's Matopo Hills.

Wilton assemblages are also defined by a combination of freehand percussion, bipolar flaking and cores that are highly worked or ephemerally occurring. Often common are bladelet cores (Deacon 1974). The late-Holocene is subdivided into Wilton, final LSA and ceramic LSA, which overlaps chronologically as well as spatially (Lombard et al. 2012, 2022). Such overlap results in slight confusion with regard to the transitions between these assemblages. This has generated a concern not only because of difficulties in identifying defining features but also the challenge of homogenising complex archaeological records into modern classes (Orton 2014).

Despite such reservations, there are specific similarities between assemblages from the same time periods even when their contexts are different. At Jubilee Shelter, a forager-occupied rock shelter (Wadley 1986), and Broederstroom, a farmer settlement with a LSA assemblage (Wadley 1996), morphologically similar stone scrapers were retrieved, indicating that both were produced by foragers and that each assemblage could be considered Wilton. In the middle Limpopo Valley, assemblages are largely consistent with the Wilton package.

There have been several excavations carried out at various sites within the middle Limpopo Valley. Among the excavated sites are LMS (Hall & Smith 2000), Balerno Main Shelter, Tshisiku Shelter, Balerno Shelter 2 (van Doornum 2005), Balerno Shelter 3 (van Doornum 2000), Dzombo Shelter, Joäo Shelter, Mafunyane Shelter, Kambaku Camp (Forssman 2014b) and Euphorbia Kop (Forssman et al. 2022). The common aim of all these excavations has been to better our understanding of the local LSA sequence. Excavations by van Doornum (2000:61) at Balerno Main Shelter were principally focused on investigating forager conceptualisation of 'space' and 'place' and how these changed through time. There are significant pre- and post-



Source: Forssman, T., 2020, Foragers in the middle Limpopo Valley: Trade, place-making, and social complexity, Archaeopress, Oxford

FIGURE 1: The middle Limpopo Valley and the region's broader social landscape showing key sites and those mentioned in the text.

contact forager assemblages, which indicate that Balerno Main Shelter was a gathering space, or an aggregation camp (Figure 2; van Doornum 2005:61). Over the course of its occupation, the use of Balerno Main Shelter did not change much. However, hunting activities at Dzombo Shelter were more emphasised, as indicated by diagnostic impact fractures on backed tools (Forssman 2015). Craft production at LMS was dominated by an increase in scrapers as well as the use-wear evidence found upon them (Forssman, Seiler & Witelson 2018; Hall & Smith 2000). At other sites, such as Tshisiku Shelter, Balerno 2 and Balerno 3, the sequence declines in density over time until it disappears all together by around AD 1300.

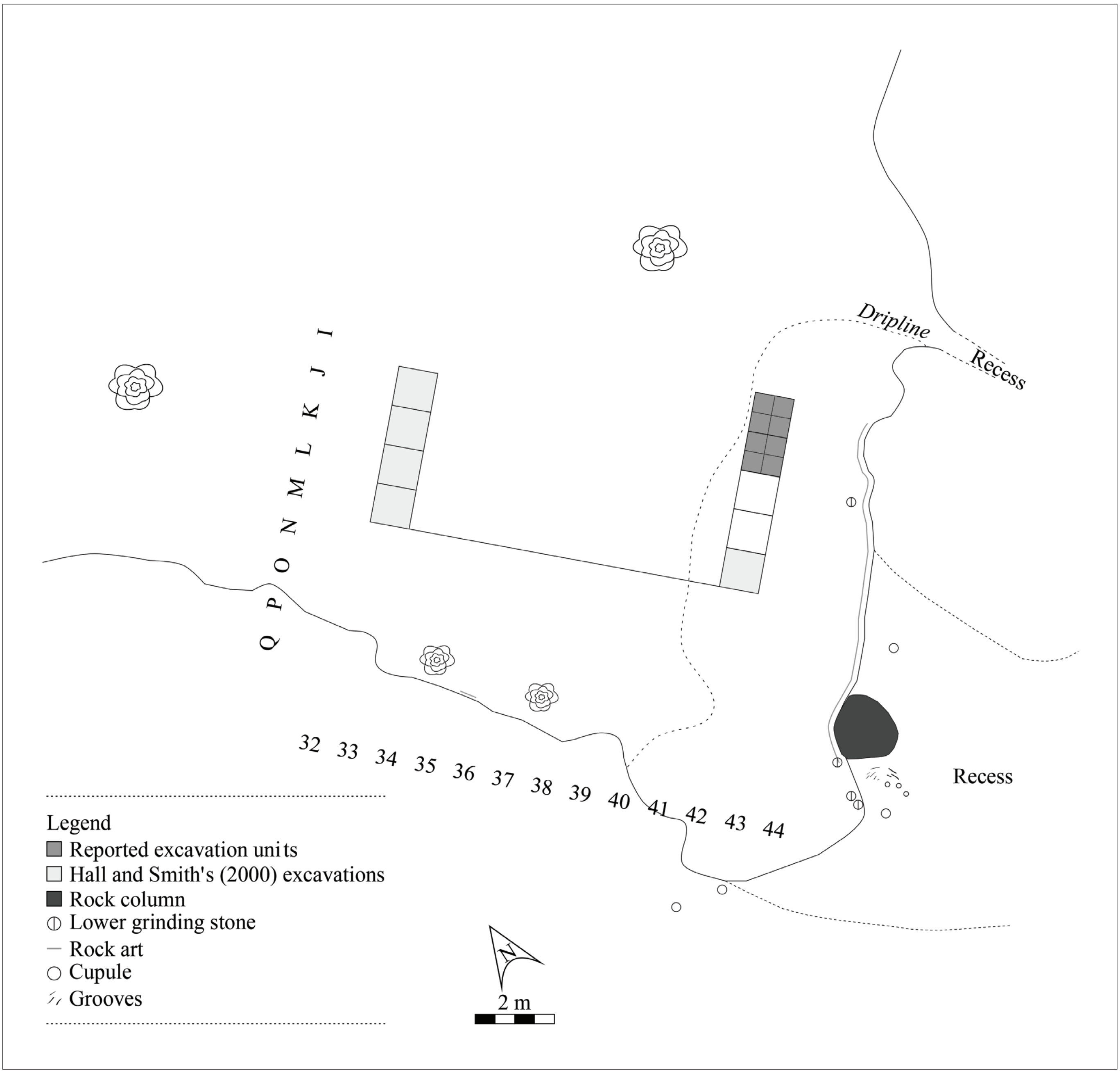
There are several general patterns represented at these excavated sites from the middle Limpopo Valley. Firstly, their tool assemblage demonstrates a preference for crypto-crystalline silicates (CCS), with the seldom use of quartz and poor representation of other material types throughout the valley's occupation. Secondly, the primary formal tool types that occur in the region are scrapers, which dominate almost all assemblages, apart from Dzombo Shelter, where backed tools are more frequent during the first millennium AD (see Forssman 2015). Valley scrapers are also small (> 20 mm in length) and often retouched along distal end followed by lateral, side retouch along one edge (Guillemard 2020). The introduction of new technologies (such as an uptick in scrapers) took place immediately after the arrival of farmers, from the first centuries AD. The current hypothesis posits that with the arrival of farmers into the Valley, foragers increased scraping tool production to necessitate trade. The increased number and density of scrapers along with the introduction of trade goods into the archaeological record during this period correspond with one another. As a result, this discounts the possibility that an increase in new technologies could have been an indigenous response by the foragers to external phenomena. The frequency of such technologies varies between sites, with some exhibiting higher frequencies than others (Forssman 2017). While these patterns of scrapers occurring during contact periods are common at most sites, it is at LMS that they are most unusual because of the sudden increase in scraper density during the contact period. Other tool forms, such as borers or adzes, are present but usually in low frequencies (Forssman 2014a; van Doornum 2005).

Thirdly, faunal consumption patterns, for which some of the tool forms would have been used, vary slightly between sites but medium-sized bovids were commonly consumed, and fish were exploited periodically, especially during the contact period. High densities of tortoise carapace indicate regular and sustained consumption and usage of this resource (Forssman 2014b; van Doornum 2005). It is not known what was behind the more common and less exploitation of small-sized bovids and fish, respectively, and this aspect has not been investigated. This description of consumption is based on a pattern recorded by van Doornum (2005) and was also noted by Forssman (2015) at Dzombo Shelter.

Hall and Smith's (2000) excavations at LMS focussed on both the internal (two 1 × 1 m squares) and open areas (four 1 × 1m squares). However, only a single internal square (L42 from near the dripline) was preliminarily analysed (Figure 2).

This square was chosen based on its central position within the excavated near the dripline. The findings showed an ordered chronology with several changes occurring from one phase to the other. Some of these changes correspond with the arrival of farmer groups and subsequent socio-economic changes in the middle Limpopo Valley. For example, from the basal levels, thought to predate the arrival of farmers by several centuries, the site was utilised as a residential campsite with limited activities. Following the arrival of farmers, changes began taking place, and this is defined by an increase in cultural material densities and the intensification of craft activities, the latter being defined by a large number of scrapers and decline in backed tools. Late in the first millennium AD, craft evidence peaks even though other artefact categories, such as the density of faunal remains, began declining. It is the view of Hall and Smith (2000) that the site was abandoned by foragers in the second millennium AD when Leopard's Kopje groups appear in the valley. As a result, it was appropriated by farmers who subsequently used it for boys' initiation.

Of particular interest for this article are the stone scrapers. From the final centuries BC, they increase significantly, appearing with greater frequency in the late first millennium AD, the Zhizo period. Hall and Smith (2000:36) argued that 'the high number of scrapers suggest production over and



Source: Hall, S. & Smith, B., 2000, 'Empowering places: Rock shelters and ritual control in farmer-forager interactions in the northern province', *South African Archaeological Society* 8, 30–46. https://doi.org/10.2307/3858044

Note: Not all of the excavated squares are shown in this map as they are not relevant to the work here and were not completed by the time the analysis was complete.

FIGURE 2: Little Muck Shelter site map showing Hall and Smith's (2000) excavations in light grey and HARP's western dripline excavation.

above the immediate forager needs, and consequently, an obvious intensification of hide production for local trade and barter'. However, use-wear analysis of the scrapers indicated the predominant function of rigid materials and almost no clear evidence showing hide working (Forssman et al. 2018). While this study by Forssman et al. (2018) was preliminary, it has since been complemented by the experimental analysis that further supports the conclusions previously reached. The latter study has further revealed a shift that occurred following the contact: prior to contact, foragers primarily worked hide, wood and shell. However, following contact, it was predominantly bone that was worked, with all other categories declining to low levels of frequency. This change may indicate a focus on activities reflecting preference patterns and trade systems. These findings are in contrast with those made at Dzombo Shelter, where there was an increase in backed tools during the first millennium AD along with evidence of damage generated by impact, likely from hunting activities (Forssman 2015). It has been argued that these different responses to farmer contact, within a relatively small geographic area, demonstrate a degree of forager autonomy (see Sadr 1997; van Doornum 2008) within the social network and elective responses to change (Forssman 2020). This highlights the danger of generalisations based on group identity.

Therefore, LMS may have played a prominent role in the middle Limpopo Valley as a site organised around the production of trade goods and the acquisition of wealth items (for examples of trade items see Wadley 1987, 1989). Producing these goods, as has been shown above, was done by using stone tools (and likely bone tools; see Bradfield, Holt & Sadr 2009). Additionally, stone technologies played a role in forager participation in larger economies and were produced in far greater quantities compared to other tools. Changes in tool production most likely reflected shifts in forager activities (i.e. an intensification of hunting activities at Dzombo Shelter), whereas a lack of change would be illustrative of their stone technology's ability to accommodate new tasks and activities without needing amendment or change. We now turn to our examination of LMS's stone assemblage with assessing these outcomes in mind.

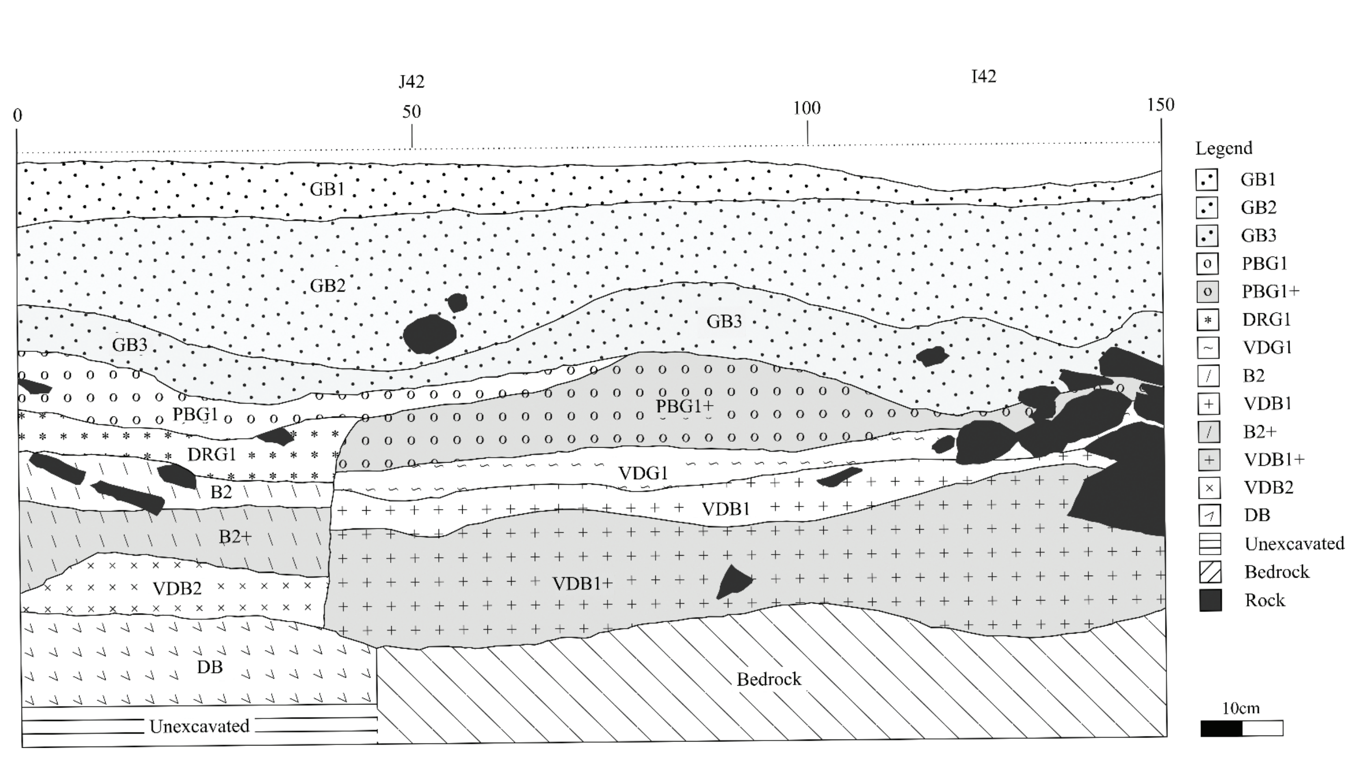
Research methods and design

Little Muck Shelter was re-excavated for four reasons. Firstly, the artefact assemblage from the first set of excavations was incomplete, and not all of the boxes are accounted for because of a serious vehicle accident (Forssman 2020:23). Considering the significance of the site, it was deemed necessary to increase the sample size, in particular, by adding lithic materials recovered from other squares across the site to aid in an improved understanding of its occupation. Secondly, the excavations carried out previously were limited. As such, results drawn could not convincingly be representative of the entire site or the valley more generally. Thirdly, there was a need to obtain radiocarbon dates for absolute chronometric results for the assemblage. Fourthly, the increase in sample size allows for a better understanding of the sites occupation and its relation to other sites within the valley.

Excavations at LMS occurred over a period of 3 years, which began in 2020 and concluded in 2022. They were carried out under the Hunter-gatherer Archaeological Research Project (HARP). These excavations followed similar technical procedures as those used by Hall and Smith (2000), expanding upon their trenches. The internal excavations were conducted in two areas: (1) the western recess of the shelter, and (2) an area near Hall and Smith's (2000) dripline excavations (Figure 2). For this study, only the results of Square J42 were examined. This is because only Square J42 represents the only area that has been completely excavated. The square's assemblage was particularly large and as a result, a sampling strategy was designed – only Quadrants A and B were analysed (Figure 3). Selecting these quadrants was intentional because of stratigraphic discontinuity reflected between the adjacent quadrants.

Excavations followed natural and cultural strata, recorded using context sheets adapted from the Museum of London Archaeological Services, which were described based on colour, compaction and composition. Stratigraphic names were ascribed using Munsell Soil Colour Chart colour values and names, followed by the order in which the layer was identified. In addition to using a stratigraphic excavation method, spits of 3 cm were maintained throughout the excavations with bucket volumes recorded to note changes in density. Spits were measured from a datum point until bedrock and not changed when a new stratigraphic layer was encountered. As such, a single spit may contain more than one stratigraphic unit if a transition was noted within a spit's range (e.g. if a stratigraphic unit [A] changed from one to another [B] at 5 cm it is within Spit 2 [3 cm – 6 cm] and so there would be a Spit 2 A and Spit 2 B unit).

The deposit reached a maximum depth of 90 cm in Square J42 A and B (Figures 2 & 3), with a total of 15 stratigraphic layers. These layers were often distinctly marked from one another; however, in other instances, particularly in the upper levels, change was discrete. Lower down in the deposit, change was also noted in the density of finds with notable increases occurring seemingly within a layer. These were differentiated by including a '+' symbol after the stratigraphic name. The upper part of these layers, from GB1 to PBG1, there is consistency between the quadrants but from about midway they appear to be disconnected. In Quadrant B, the stratigraphic layers PBG1+, VDB1 and VDB1+ are included in addition to the pre-existing stratigraphic units. PGB1+ and VDB1+ are stratigraphic units with an increased artefact density, and unit VDB1 is limited to Quadrant B. Within the greater aim of the study, to analyse stone tools used by foragers for potential continuities and discontinuities over time, the purpose of focusing on Quadrants A and B was to investigate whether the stratigraphy reflects different tool histories between these two areas. To do so, relative



Source: Hall, S. & Smith, B., 2000, 'Empowering places: Rock shelters and ritual control in farmer-forager interactions in the northern province', *South African Archaeological Society* 8, 30–46. https://doi.org/10.2307/3858044

FIGURE 3: Little Muck Shelter, J42A-B I42A North Wall.

dating methods were used because of a lack of radiometric results at the time of writing. Relying on cross typological references, by looking at the occurrence of specific chronological markers such as scrapers, backed tools, decorated ceramics and glass beads, it is possible to establish broad chronological phases because of the well-dated LSA and Iron Age sequences for the region (e.g. Huffman 2007; van Doornum 2014; Wood 2000). However, changes in stone tool types are not refined enough to establish chronological phases, as is possible with ceramics, for example, and can only be used to mark more general industry groups, such as Wilton. Therefore, the use of beads and ceramics was relied upon (from Barnard 2021) and their stratigraphic relationship with the stone tools sequence (Table 1).

Artefact analysis took place in several phases. Preliminary sorting of the assemblage was conducted in the field where the assemblage was separated into fauna, shell, bead, ceramic, metal, stone tools and others where necessary (e.g. glass). This article is principally concerned with stone tools. The materials were subsequently re-sorted at the University of Pretoria archaeological laboratory, and any misidentified artefacts were placed into their relevant bags. The raw materials were then weighed with an electronic scale, in grams, to calculate artefact density throughout the deposit when compared to bucket volume of recovered material.

Stone tools were analysed following two methodological approaches: (1) van Doornum's (2005) typology, which was adapted from Deacon (1984) and Walker (1994), as well as (2) Guillemard's (2020) study at Balerno Main Shelter. The recording techniques and approaches followed those outlined by Lotter et al. (2018) stone tool analysis workbook. The aim of the analysis was to typologically analyse all the stone tools to compare them to previous studies in the area while also recording morphological and technological attributes of the stone assemblage. Publications by Guillemard and Porraz (2019), and Guillemard (2020) aided in providing new insights into a technological and morpho-functional approach. This approach was not applied in this study but does provide guidelines from which to follow in lithic studies. Using both of these studies, a typological and technological analytical approach was used to analyse the lithic assemblage.

Stone tool assemblage was divided into two primary groups: (1) small flaking debris (SFD) and (2) non-SFD (Figure 4). Small flaking debris are stone tools less than 10 mm in maximum length with no signs of secondary working such as retouch or backing. These SFD lithics were weighed and not sorted further. To calculate for a total of 10% of the total SFD mass, the SFD specimens were separated into measures of 20 SFD specimens per weight to calculate an individual SFD weight projection. This allows for the comparison of the projected SFD across the stratigraphic layers. It further enables for the use in future projects that would use 10% of the total SFD mass to provide their study with an SFD projection. This, multiplied by the total mass, generated a total numeric SFD projection for comparative purposes. Stone tools that fell within the non-SFD (>10 mm) category received additional analysis. This included identifying their raw material, measuring maximum length, width and

TABLE 1: Stratigraphic units found in Square J42 A and B.

Unit	Description of deposit	Relative chronology	Cultural affiliation
GB1 (31 L)	A fine greyish-brown sand with rock and root inclusions. Evidence of bioturbation and root penetration. This is an unconsolidated surface.	Post c. AD 1800 AD 1220–1300	Historic/Venda Mapungubwe
GB2 (72 L)	A fine but compact greyish-brown sand with root inclusions, which could be a more compact version of GB1. Evidence for bioturbation and root penetration.	AD 1220–1300 c. AD 1220–1250	Mapungubwe Transitional K2
GB3 (29 L)	A pale greyish-brown ash that is more textured and includes a greater number of rock inclusions than GB2. Root penetration was evident within the unit.	AD 1000–1220	Leokwe/K2
PBG1 (27 L)	A fine textured, ashy sand with rock and pebble inclusions. Evidence of root penetration and bioturbation. A very slight change from the previous unit.	AD 900–1000	Zhizo
PBG1+ (8 L)	The only distinct change from PBG1 is an increase in artefact density.	-	-
DRG1 (17.5 L)	Fine textured, darkish brown silt/clay; the unit was not coarse enough to be identified as sand. Rock and root inclusions.	First millennium, pre-AD 900	Happy Rest/ Bambata
VDG1 (33 L)	Fine textured, dark grey ash with sandstone inclusions. Bioturbation was evident within the unit. Evidence for root penetration and bioturbation (J42 B). Unit occurs throughout J42 B and I42 A and is parallel to unit B2 in J42 A.	First millennium AD, pre-contact?	Bambata/Wilton?
B2 (8.5 L)	Richer, more distinct brown sand than in DRG1 (unit above B2 in J42 A) with a fine texture. Evidence for root penetration and bioturbation, along with rock and root inclusions. Unit occurs throughout J42 A only.	-	-
VDB1 (4 L)	Medium textured sand with rock inclusions. The dark brown colour of the deposit appears wet. Evidence for root penetration and bioturbation (J42 B). Unit occurs throughout J42 B and I42 A and is parallel to unit B2 in J42 A.	First millennium AD, pre-contact?	Bambata/Wilton?
B2+ (8 L)	The only distinct change from the previous unit is artefact density. Unit occurs throughout J42 A only (unit after B2).	Late BC to early first millennium AD periods	Wilton
VDB1+ (31 L)	The only distinct change from the previous unit is artefact density (J42 B). Unit occurs throughout J42 B and I42 A and is parallel to unit B2+ in J42 A.	Late BC to early first millennium AD periods	Wilton
VDB2 (103 L)	A thin, fine-textured, brown layer of sand above bedrock. Evidence of bioturbation and root penetration.	Pre-AD 100	Wilton/ pre-ceramic
DB	Decayed bedrock	n/a	n/a

GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

thickness and recording condition, cortex percentage, blank type, primary type and completeness (following Lotter et al. 2018). The non-SFD was further sorted into four main categories: (1) complete flakes, (2) incomplete flakes, (3) formal tools, and (4) cores.

Each of the aforementioned categories received different analytical treatment. This is because not every category is analysed with all aspects outlined in the criteria. This also allows for a focused analysis on specific categories to generate data that is comparable with other LSA sites. Incomplete flakes and the raw material were identified and the specimens counted. For complete flakes however, raw material was identified, maximum length and width were taken and the presence of cortex was recorded as a percentage of the dorsal surface. Cores were also measured, and their raw material identified with their maximum thickness also recorded together with the percentage of cortex around the tool. They were then classified following core definitions provided by van Doornum (2005) including irregular, bladelet, bipolar, single or multiple platforms, rice seed cores based on the striking platform locations and types and the flake scars. Formal tools (iii) received the most analysis, which included raw material identification, maximum length, width and tool thickness. Their condition was also recorded (complete, incomplete, broken, or freshly broken) and the percentage of cortex on the dorsal surface noted. It must be highlighted, however, that the condition of stone tools, much like other morphological or typological aspects of stone tool analysis, is subject to interpretation of the person analysing the material. It is up to the discretion of the technician to identify these changes on tools from an assemblage, bringing in the element of subjectivity. It should also be noted that some tools may be accidentally broken during either excavation or while being assessed at the laboratory. Recording the conditions of stone tools is thus necessary to provide the most accurate description of a stone tool as possible. Formal tools are analysed in this way to provide as much information as possible as their numbers and densities are lower than that of the other non-SFD categories, and they can inform about the changes in the dominant tool type during different periods of a site's occupation.

Subsequently, formal tools were further sorted into three primary types:

- retouched piece,
- backed piece, or
- backed and retouched piece.

These categories were further sub-divided into:

- scraper,
- scraper adze,
- miscellaneous retouched piece (Misc. RP),
- retouched flake,
- retouched blade/bladelet (retouched pieces),
- bladelet,
- broken backed piece,
- miscellaneous backed piece (Misc. BP),
- segment, and
- segment backed bladelet (backed pieces).

Where applicable, a combination of these tool types can occur, where both retouch and backing were recorded. Scrapers were further subdivided into categories (also referred to as scraper type) determined by the location of retouch, being end, side or combination scrapers. An example

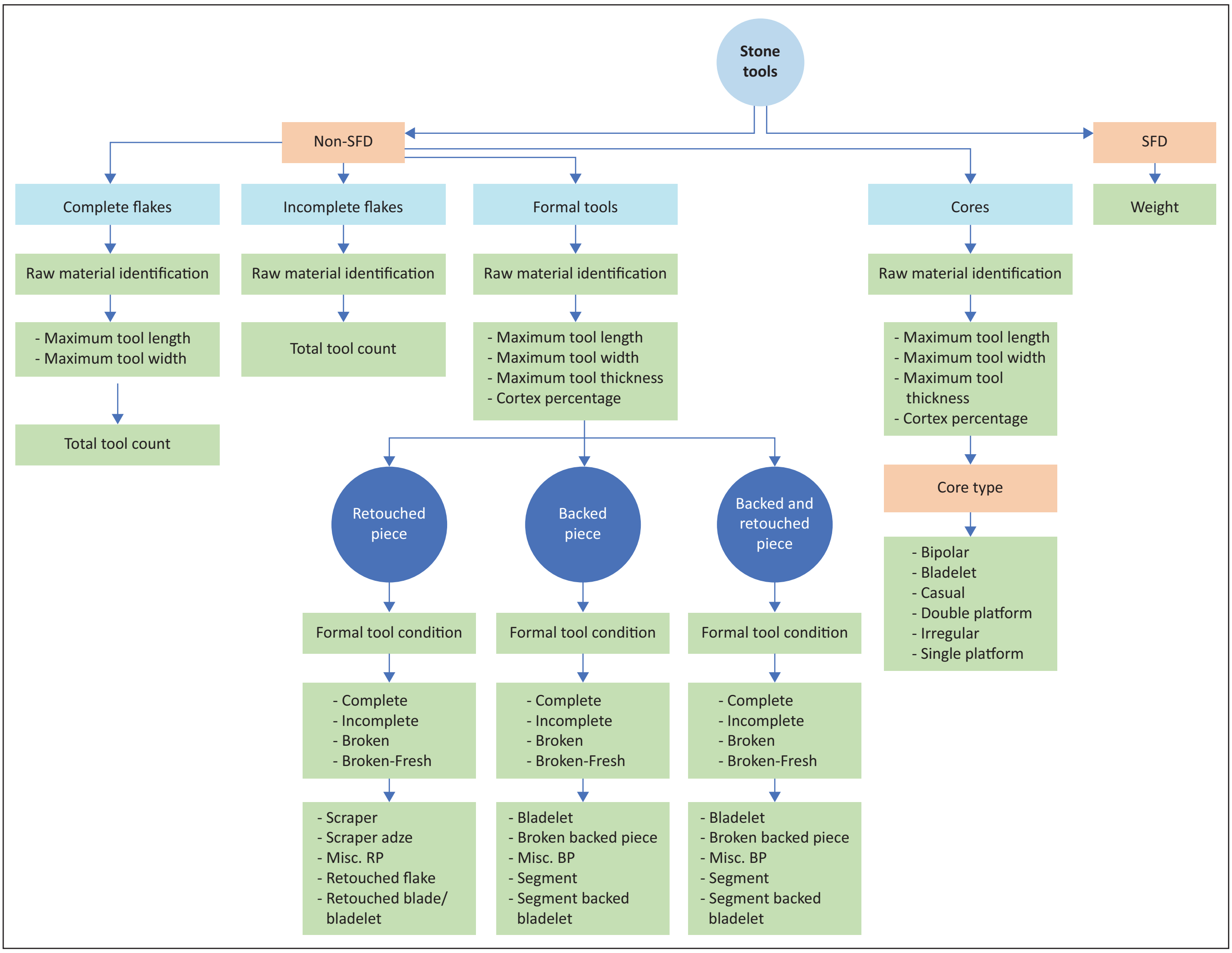


FIGURE 4: Figure representing the division of stone tools into varying categories.

of a combination scraper can be identified as end-side scrapers. These are the different scraper types that can occur within an assemblage (Figure 9). Among these are the end scrapers, side scrapers or a combination scraper (i.e. end-side scraper). Considering that scraping tools perform specific functions, having them split into specific categories meant that we can better identify their possible use prior to conducting use-wear analysis as seen in Forssman (2015).

Results

A large stone tool assemblage was excavated from Square J42 A and B, providing a sufficient sample for analysis. A total of 15 630 tools were analysed, amounting to 35 217 g in weight. Small flaking debris pieces that were not counted had a weight of 4301 g. Close to 10% of the SFD mass was divided into sets of 20 pieces (119 sets with a mass totalling 427.9 g) and weighed to calculate the average mass per piece to produce a numeric projection. We estimate that there are approximately 23 894 SFD pieces, which amounts to 60.1% of the assemblage and non-SFD is 39.9%. The volume of tools per stratigraphic unit (L) is outlined below with the number of tools per litre (/L).

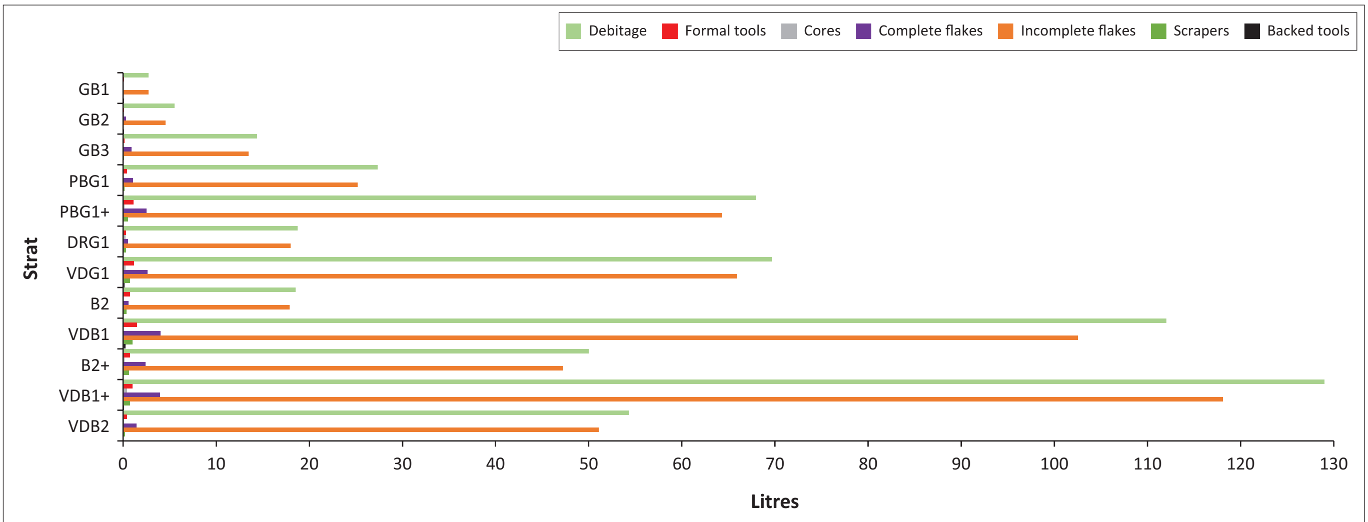
In the bottom layers the stratigraphic unit with the densest collection of artefacts is VDB1+ (130.58/L). VDB1+ includes the highest density of debitage (128.97/L), incomplete flakes (118.1/L) and cores (0.42/L). Formal tools are densest in VDB1 (1.50/L), the formal tool subtype scrapers comprise (1.00/L) and backed pieces (0.25/L). Scrapers and backed pieces reach a peak density within VBD1. This corresponds with complete and incomplete flakes and formal tools. The density of both complete and incomplete flakes is higher in the lower levels of the stratigraphy and decline as the stratigraphy continues to the surface units (Figure 5). Cores sparse with low densities occurring throughout the stratigraphy. There are two distinct peaks in VDB1+ (0.42/L) and VDG1 (0.27/L). With the change in the artefact groups throughout the assemblage, the density and number of formal tools have distinct peaks in the middle stratigraphic units, despite the decline in complete flake, incomplete flake and core densities. This leads one to infer that even though there was a declining density in raw materials per each stratigraphic unit (a lower number and density of cores, complete and incomplete flakes per stratigraphic unit), there was still an increase in the presence of formal tools. It may be reasonable to assume that formal tools may have been produced outside of the square elsewhere at the site or perhaps produced elsewhere and was brought to the site for reworking purposes.

The most dominant raw material type is CCS (chalcedony and chert) (*N* = 10 037; 27.05/L; 64.22%), followed by quartz (*N* = 4968; 13.39/L; 31.79%), agate (*N* = 202; 0.54/L; 1.29%), quartzite (*N* = 137; 0.37/L; 0.88%), indeterminate (*N* = 8; 0.02/L; 0.05%) and dolerite (*N* = 1; 0/L; 0.01%) (Figure 6). Crypto-Crystalline Silicates dominates throughout all the stratigraphic units in the assemblage followed closely behind by quartz. There are 479 artefacts (3.06%; 1.29/L) that are identified as NA; this was used for tools that were tallied up such as pebbles, shattered/indeterminate and block pieces found in manuport and debitage.

Cores are infrequent in the assemblage with only 42 specimens (0.27% of total assemblages) in the two quadrants. This number will undoubtedly rise as additional squares are analysed. The highest density was retrieved in the bottom layers from VDB1+ (*N* = 13; 0.42/L; 30.95%), followed by VDG1 (*N* = 9; 0.27/L; 21.43%) in the lower layers. The dominant core type is single platform cores (*N* = 24; 57.14%), followed by double platform cores (*N* = 6; 14.29%), bipolar cores (*N* = 4; 9.52%), bladelet cores (*N* = 3; 7.14%), irregular (*N* = 3; 7.14%) and casual cores (*N* = 2; 4.76%). Little can be said of these figures but what is interesting is the emphasis on freehand percussion. In other LSA assemblages, bipolar cores are most common. However, freehand percussive techniques appear to have been preferred at LMS, with fewer identifiable core types. This, of course, would require additional analysis to confirm because of the small assemblage size used in this study. Cores reach a peak density in VDB1+ (0.42/L), which illustrates a period of activity starting in the late BC to early first millennium AD periods, VDG1 (0.27/L) is first millennium AD, pre-contact and DRG1 (0.23/L), which is first millennium pre-AD 900 (Figure 7).

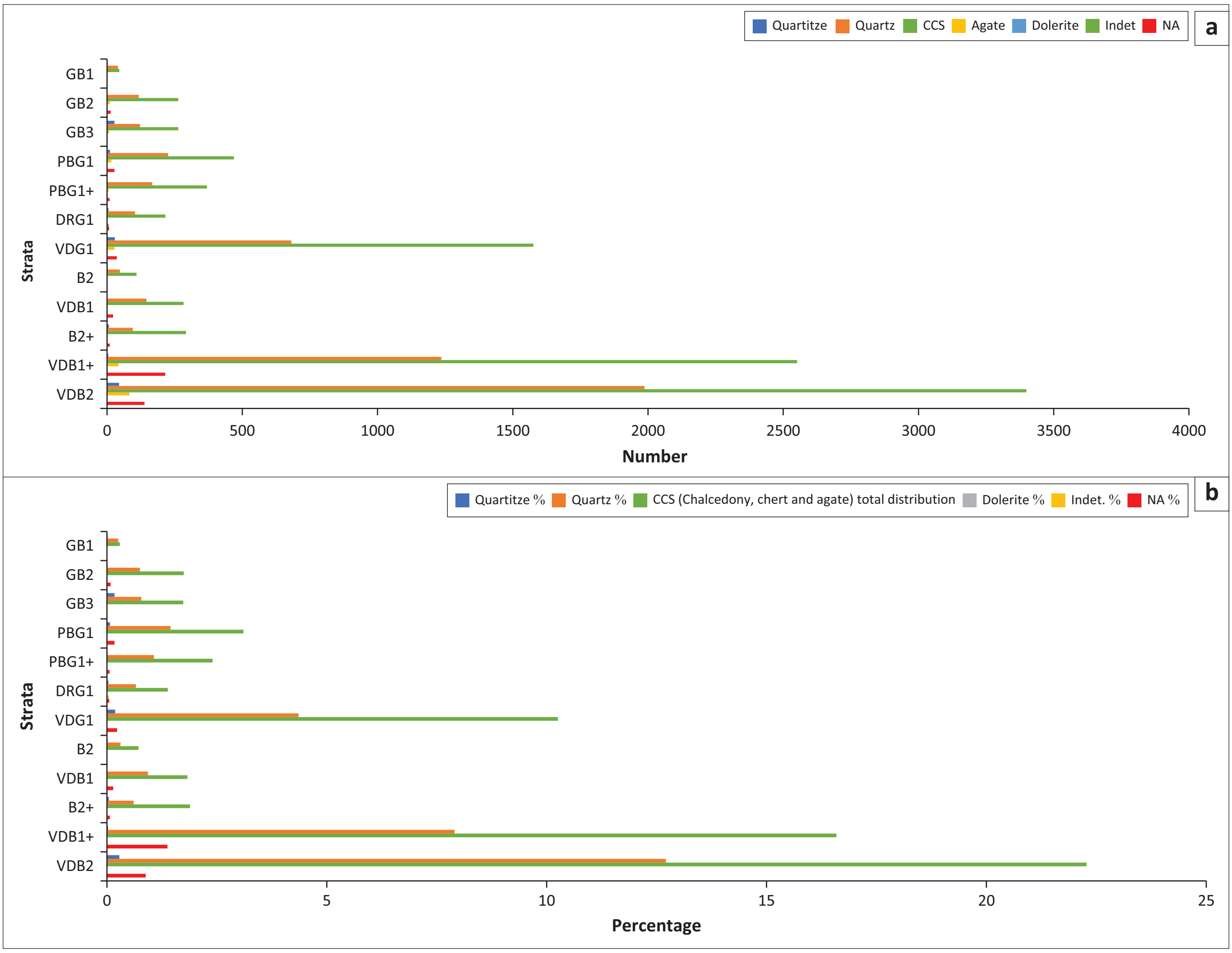
The formal tool category is dominated by scrapers (*N* = 96; 0.61% of total assemblage). Of these, the most common are end scrapers (*N* = 60; 63.16%), followed by side scrapers (*N* = 15; 15.79%), circular (*N* = 14; 14.74%), end-side (*N* = 5; 5.26%) and indeterminable (*N* = 2; 2.11%) (Table 2). Scrapers number and density are low throughout the stratigraphic profile. This is also confirmed by the R^2 value (R2 = 0.43) that illustrates a downward trend in scraper density from the bottom layers through the lower layers and until the surface layers. Hall and Smith (2000) argued that the increase in scraper tools was because of an increase in craft production at the site for trade with the local farming communities. Scraper density peaks in VDB1 (1.00/L) from which a limited number of end scrapers (*N* = 4) that were the most common type were recovered. There is a pattern of increased activity from VDB2 until the peak in VDB1, which is from pre-AD 100 until the first millennium AD, pre-contact period. There is a decline between the late BC to early first millennium AD periods in B2+. An increase in scraper density occurs within PBG1+, which is within AD 900 – 1000, a Zhizo period. End scrapers dominate the assemblage across most stratigraphic units. However, in GB3, the dominant scraper type is a side scraper, and a circular scraper that is both low in number and density (Figure 8 and Figure 9). The largest variation of scraper type occurs in VDG1, which corresponds to a peak in scraper density within the lower levels.

Hall and Smith (2000) noted the highest density of scrapers in their PBG3 level, dating to the Zhizo period. However, in Square J42, two meters away, it was in the pre-contact phase that the highest density of scrapers were retrieved. This either suggests that space at the site was used differently over time, that discard patterns changed or that post-depositional processes have influenced the archaeological assemblage. Based on the recurring pattern in the different squares excavated by HARP, we suspect that the higher density of finds is representative and is a more accurate indicator of pre-contact occupation patterns.



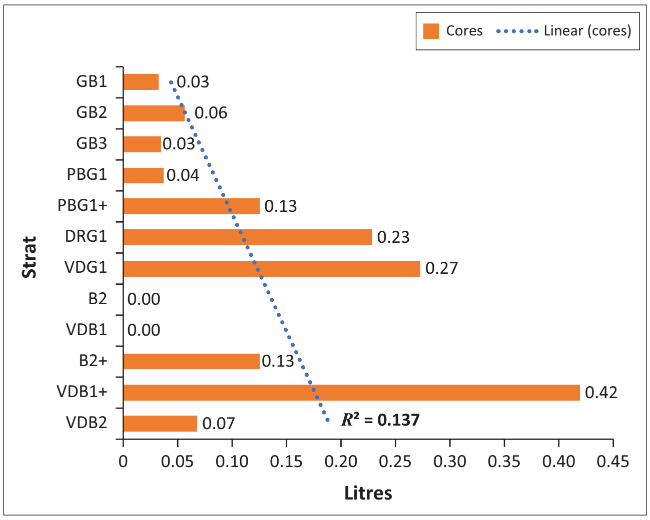
Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

FIGURE 5: Little Muck Shelter Stone tool type distribution in J42 A and B.



Strata, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2; Indet., Indeterminate; NA, not applicable.

FIGURE 6: Graphs illustrating the change in raw material across strata by number (a) and percentage (b).



Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

FIGURE 7: Density of core distribution across strata in Little Muck Shelter J42 A and B.

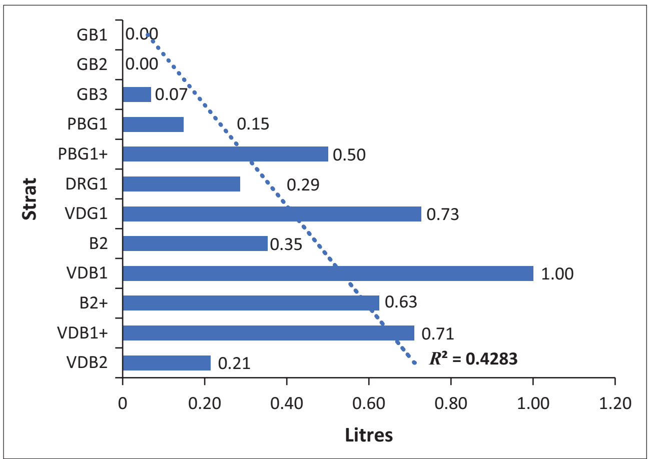
TABLE 2: The distribution of Little Muck Shelter's scraper types in number J42 A and B.

Strat	End	Side	End-side	Circular	Indeterminable
GB1	0.00	0.00	0.00	0.00	0.00
GB2	0.00	0.00	1.00	0.00	0.00
GB3	0.00	1.00	0.00	1.00	0.00
PBG1	4.00	0.00	0.00	0.00	0.00
PBG1+	4.00	0.00	0.00	0.00	0.00
DRG1	0.00	3.00	0.00	0.00	**2.00**
B2	3.00	0.00	0.00	0.00	0.00
B2+	5.00	0.00	0.00	0.00	0.00
VDG1	**14.00**	4.00	3.00	3.00	0.00
VDB1	4.00	0.00	0.00	0.00	0.00
VDB1+	13.00	4.00	1.00	4.00	0.00
VDB2	13.00	3.00	0.00	6.00	0.00
%	**63.16**	**15.79**	**5.26**	**14.47**	**2.11**
Total	**60.00**	**15.00**	**5.00**	**14.00**	**2.00**

Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; B2, Brown2; B2+, Brown2+; VDG1, Very dark grey1; VDB1, Very dark brown1; VDB1+, Very dark brown1; VDB2, Very dark brown2.

The overall scraper size had increased from VDB2 until the largest overall scraper size was recorded in VDB1. This occurs within the bottom layers where the greatest average length 21.43 mm and width 18.13 mm are recorded (Table 3). The highest density of scrapers for the assemblage (Figure 8) was recorded in VDB1, which is within the bottom layers. The size of LMS scrapers remain consistent when considering the average length and width. The largest average thickness of a scraper is 13.98 mm from VDG1 in the lower units. Scraper size remains consistent from the lower layers until the beginning of the surface layers.

Backed pieces are outnumbered by scrapers in both number and density (*N* = 21; 0.12% of total assemblage). This includes segments (*N* = 13; 61.90%), bladelets (*N* = 3; 14.29%), segmented backed bladelets (*N* = 2; 9.52%), MBP (*N* = 2; 9.52%) and a broken-backed piece (*N* = 1; 4.76%) (Table 4). Backed pieces are low in number and density, and this is supported by the R^2 value (R2 = 0.018), which indicates that there is a decreasing density of tools from the bottom



Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

FIGURE 8: Density of scrapers in Little Muck Shelter, Square J42 A and B.

stratigraphic layers through until the surface layers. There is a peak density of backed pieces in the bottom layers, VDB1 (*N* = 1; 0.25/L) where they are at their densest.

The numbers and density of backed tools are low overall; this places these densities within the first millennium AD. In the middle layers, the peak backed piece density occurs in VDG1 (*N* = 4; 0.12/L) (Figure 10). VDG1 is relatively dated to first millennium AD and possibly culturally affiliated with Happy Rest. Low frequencies of backed tool occur in levels post-dating the late first millennium AD, PBG1 (*N* = 1; 0.04/L), GB2 (*N* = 4; 0.06/L) and GB1 (*N* = 3; 0.10/L), which reflects Hall and Smith's (2000) findings. Between B2+ and PBG1+ the presence of backed pieces is reduced to (0/L), between the late BC to early first millennium and AD 900–1000 periods. There is a brief increase in density in AD 900–1000 within PBG1 (0.04/L) and again from approximately AD 1220–1250 to around AD 1300.

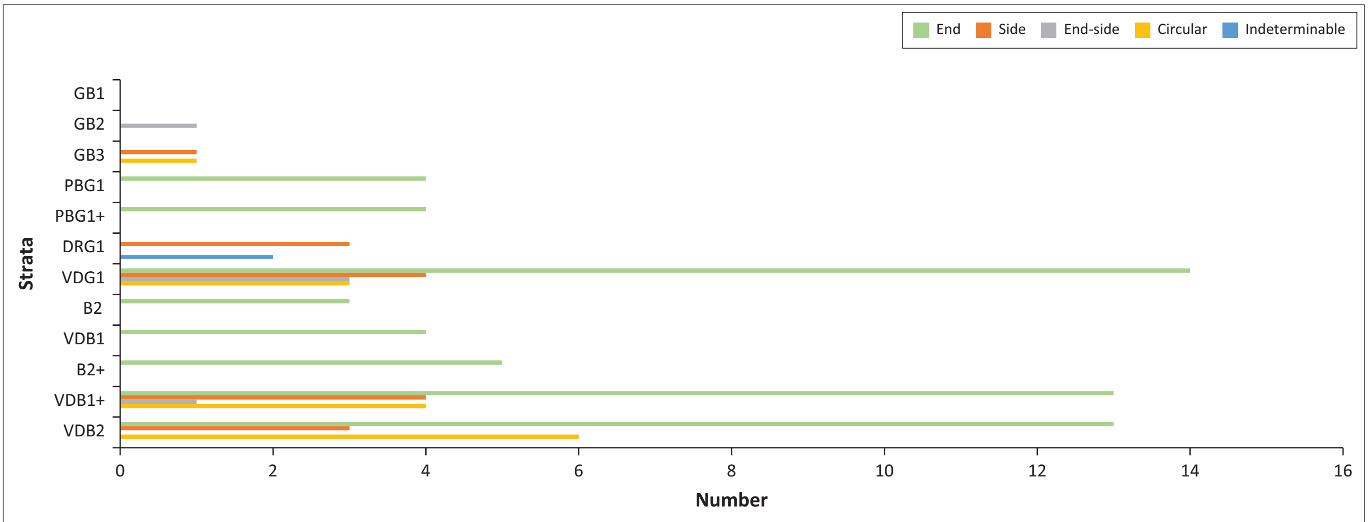
Discussion

As already demonstrated by Forssman et al. (2018), it is possible to examine stone assemblage provenances from pre-

TABLE 3: Distribution of scraper size averages across strata.

Order	Strat	Average length (mm)	Average width (mm)	Average thickness (mm)
1	GB1	0.00	0.00	0.00
2	GB2	0.00	0.00	0.00
3	GB3	13.25	16.00	4.50
4	PBG1	14.25	12.38	4.50
5	PBG1+	16.75	13.00	6.00
6	DRG1	11.00	9.30	2.00
7	VDG1	16.05	13.98	13.98
8	B2	16.07	13.23	5.07
9	VDB1	21.43	18.13	6.30
10	B2+	15.90	12.70	5.10
11	VDB1+	16.39	12.91	4.94
12	VDB2	17.39	12.68	4.96

Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.



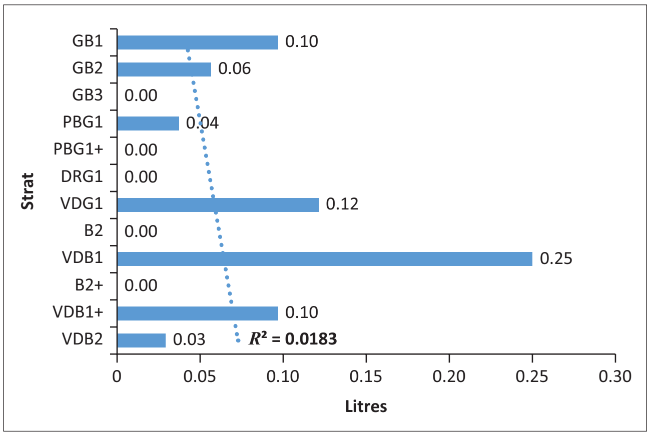
Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

FIGURE 9: Bar graph illustrating the change in scraper type across strata.

TABLE 4: Backed piece types in J42 A and B.

Backed piece	Number	%
Segment	13	61.90
Triangle	0	0.00
Trapeze	0	0.00
Flake	0	0.00
Blade	0	0.00
Bladelet	3	14.29
Segmented backed bladelet	2	9.52
Misc. BP	2	9.52
Broken backed piece	1	4.76
Total	**21**	**100.00**

Misc. BP, Miscellaneous backed piece.



Strat, Stratigraphy; GB1, Grey brown1; GB2, Grey brown2; GB3, Grey brown3; PBG1, Pale brown grey1; PBG1+, Pale brown grey1+; DRG1, Dark reddish grey1; VDG1, Very dark grey1; B2, Brown2; VDB1, Very dark brown1; B2+, Brown2+; VDB1+, Very dark brown1; VDB2, Very dark brown2.

FIGURE 10: Density of backed pieces in Little Muck Shelter J42 A and B.

and contact levels to indicate changes over time. These changes correlate with the arrival of farmer groups, as specifically shown by the increase of scrapers. This suggests that a growing market appeared in the first millennium AD, indicating the participation of foragers in this economic system. However, what is not known is the impact such markets had on stone tool technologies. For example, do production patterns change, were they producing tools more efficiently than before, did they alter the form of their formal tools to accommodate new tasks and activities or did their form develop over time and did the use of tools decline as other technologies such as metal appeared on the landscape and in forager assemblages? The site is ideally situated to assess this as it clearly shows change related to social relations occurring in the valley.

Although only relative dating techniques have been used to date the site, the deposit appears intact and unaltered from the time it was occupied. Using well-established chronological markers, Barnard (2021) produced a relative sequence for HARP excavations of LMS, and this agreed with the findings of Hall and Smith (2000). It is not possible to determine a basal chronology without clearer markers, but it is suspected that the VDB1 levels predate the arrival of farmer groups based on a lack of farmer-related items and a clearly Wilton-like assemblage. However, above this, from VDG1, ceramics appear, and these may be Bambata or Happy Rest. It is clear though that from the level above DRG1, Happy Rest ceramic users were locally present as diagnostic examples have been retrieved from this level at the site. This indicates that DRG1 date from the mid-first millennium AD. Above DRG1 is PBG1+ and PBG1, which is akin to Hall and Smith's (2000) PGA3 and dates to the Zhizo period. Diagnostic ceramics and typical snapped cane glass beads that have been identified indicate as much. Post-dating the Zhizo period is the K2 period, and similar diagnostic finds have been made in the overlying GB3 unit. At the interface of GB3 and GB2 above, a transitional K2 sherd was recorded while excavating (Square I42 C), dating from AD 1200 to 1250. Further above are the Mapungubwe wares and beads. However, GB2 also contained some 19th century items, particularly beads, and it is possible that some mixing has taken place here. GB1 was an unconsolidated surface unit, and it is suspected that these artefacts may be out of context and mixed. It is important to note that the purpose of analysing Quadrants A and B in Square J42 was also to understand the different stratigraphic units. However, it was not possible to do so based on the findings as too few diagnostic markers were found in B2+ and B2 to warrant a detailed understanding. It may thus be that the divide represents a cut or pit and fill or is the results of erosion and backfilling.

During LMS's occupation from the final centuries BC until AD 1300, did the stone assemblage change in such a way that one might conclude their technology had changed? It is plainly seen that scrapers dominate, and in Hall and Smith's (2000) study, they became incredibly abundant when compared to sites such as Balerno Main Shelter or Dzombo Shelter, occupied over the same period. However, preference for a specific tool type does not imply that their technology changed but rather that preference patterns did. This might be linked to activities associated with craft production, possibly labour roles or other demands and certainly aligned with forager skillsets. If one looks closer at the scraper forms, little changes from the basal levels into the second millennium AD are conclusive. In both Hall and Smith's (2000) findings and those presented here, small, CCS scrapers dominate that mostly have a single worked edge, which is more often the distal end followed by the lateral edge. This trend exists throughout the assemblage with a slight preference for larger tools in the second millennium AD. The general consistency in scraper form though, from the pre-contact and into the contact period, does not indicate that any important change in tool type took place; morphologically similar scrapers were consistently produced during the occupation of the shelter.

Why might this be significant? One of the key features of LMS is its potential involvement in the trade system. Items were being produced and traded into the larger market with farmers. This is indicated by an increase in farmer trade wealth at the site from the mid-first millennium AD (Barnard 2021). Over the course of the site's occupation, this aspect of forager life habits, skillsets or production patterns was emphasised, and production was at levels that exceeded the needs of those living at the site (Hall & Smith 2000). Therefore, it is reasonable to conclude that this aspect of the forager toolkit, in this context and under these conditions, absorbed the greatest amount of strain regarding changing markets and activities. It was their role, above all others at the site, which was most heavily utilised. Given this, foragers were not under pressure to change their technology as it was capable of accommodating such change and able to be deployed in different activities. Moreso, the production of these tool types also did not need to change to account for their greater rate of production, reproduction through use and maintenance. The usewear results are of significance in this context because they show a shift from hide, wood and shell to predominantly bone. Therefore, the consistency is not related to a consistent working of the same materials. As such, these small scrapers were effective on a variety of materials, despite the demands, and did not need to be altered. Forager tool technology could accommodate the changes brought upon by the arrival of farmer communities and the appearance of new activities.

Although the core assemblage is too small to draw any meaningful patterns, it does at this stage reflect a degree of continuity. The various core forms are distributed across the assemblage with little evidence indicating change. This may suggest that production techniques did not change over time, in line with the lack of morphological change in the scraper assemblage. The length and width data from the complete flakes also reflect consistency in the size of flakes, and in a related fashion that of cores, over time. Little, in fact, changes at LMS other than a clear shift in the density of remains. In the lower levels that predate the arrival of farmer groups stone tool production is at its highest. However, as farmers appear in the extended region, by the mid-first millennium AD, frequencies begin to decline and only peak, temporarily, in the Zhizo period (AD 900–1000), after which they drop more rapidly than before. This is somewhat at odds with Hall and Smith's (2000) results that showed lower frequencies of tools in the pre-contact levels than after. This may reflect differential use of the shelters space over time or geoarchaeological processes. Nonetheless, these shifts in stone tool densities are the only clear change noted in this assemblage relative to chronology. Therefore, while farmers may have contributed to a declining trend of tool production, which may relate to forager population dynamics, settlement habits or restricted activities, they did not stimulate obvious change in stone technologies.

Conclusion

The middle Limpopo Valley offers a unique archaeological record that saw foragers with LSA technologies interact with Iron Age farmers as they underwent significant socio-political changes. LMS, in many ways, reflects these changes. Corresponding with the arrival of farmer groups, and subsequent changes in their society, are shifts at LMS. These can be tracked through the deposit in terms of artefact densities, the increase of scrapers and decrease of backed tools as well as other types and the appearance of ceramics, glass beads and metal. Nearby, at Leokwe Hill and the Mbere Complex, important changes took place within the farmer social landscape that involved the appearance of hierarchies and the growth of craft economies. Those foragers living at LMS during this period were undoubtedly aware that these changes were taking place and took advantage of them, producing various craft goods and using them to obtain other items usually considered to mark wealth and prestige (see Denbow 1990; Denbow & Miller 2007). The result was a shift in forager activities, the intensification of certain production patterns, and the involvement of foragers in an economic system that was still relatively new to the region. Despite the appearance of new technologies and their production strategies, referring specifically to metal, forager stone technologies remained constant. Preferences changed, such as a greater drive for scraper tools, but their production and morphology remained similar, if not the same, as pre-contact examples. This lack of stone technology distinction between pre- and contact assemblages is a feature apparently visible on many other landscapes and therefore reflects a trend that the appearance of state-level society, and all that comes with this transformation, did not impose drastic changes.

It is not entirely clear why stone technologies remained similar, but several possibilities are worth considering. It may be that forager stone technologies were very capable of accommodating changes in activities. So too, in that case, would they be able to account for increased production requirements. In this case, they were efficient pieces of technology that were effective in a range of tasks and could be utilised even when the rate of activities increased. The material being worked, which came to be bone, also did not seem to have an impact on the form and function of LMS's scrapers. This all speaks to a much bigger issue of using stone tools to explore identity, which as Denbow (2017) warned more generally, might be harder to recognise in archaeological sequences that exhibit continuity over time despite what social change may have been taking place.

Exploring these various possibilities, and others, is certainly possible at LMS and other sites in the area. Examining inter-site differences in a far more comparable and detailed manner would help to assess whether regional change was diachronic or if similar patterns were noted at other sites. It also seems possible that, at LMS, spatial distribution of activities changed over time and once fully examined, other activity areas may emerge as well as currently unrecorded changes in the stone assemblage. Furthermore, techno-functional analyses applied to cores, blanks and retouched flakes (Guillemard 2020:200) may provide subtle changes that correspond with social change across the landscape in ways that tool morphology and preferences cannot. As such, there is still much to understand about change across the contact divide or the lack of it and future work that compares contemporaneously might assist.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

The author, J.A.P. assisted with writing the original draft article, reviewing, editing, visualisation, formal analyses and funding acquisition. N.L.S. assisted with methodology, formal analyses, validation and supervision. T.F. assisted with conceptualisation, funding acquisition, supervision, writing, reviewing and editing.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

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Data availability

The authors conceived the study and prepared the document themselves.

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