



Renewed impetus for Stone Age research in the Eastern Free State (South Africa) centred on Rose Cottage Cave

Viola Schmid, Wadley Lyn, Brandl Michael, Iris Guillemard, Sara E. Rhodes, Noora Taipale, David M. Witelson, Mario Börner, Dries Cnuts, Tammy Hodgskiss, et al.

► To cite this version:

Viola Schmid, Wadley Lyn, Brandl Michael, Iris Guillemard, Sara E. Rhodes, et al.. Renewed impetus for Stone Age research in the Eastern Free State (South Africa) centred on Rose Cottage Cave. South African Archaeological Bulletin, 2024, 79 (221), pp.105-119. <hal-04926067>

HAL Id: hal-04926067

<https://hal.science/hal-04926067v1>

Submitted on 3 Feb 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

RENEWED IMPETUS FOR STONE AGE RESEARCH IN THE EASTERN FREE STATE (SOUTH AFRICA) CENTRED ON ROSE COTTAGE CAVE

VIOLA C. SCHMID^{1,2,3*}, LYN WADLEY⁴, MICHAEL BRANDL^{1,2}, IRIS GUILLEMARD^{5,6}, SARA E. RHODES⁷, NOORA TAIPALE^{8,9}, DAVID M. WITELSON⁶, MARIO BÖRNER¹, DRIES CNUTS⁸, TAMMY HODGSKISS¹⁰, MAY MURUNGI^{7, 11}, PHILIP R. NIGST^{12,2}, GUILLAUME PORRAZ¹³, ELYSANDRE PUECH¹⁴, VEERLE ROTS^{8,9}, MAREIKE C. STAHLSCHMIDT^{15,2}, STEFANIE STELZER¹⁶, NICOLAS TEYSSANDIER¹⁷, CHANTAL TRIBOLO¹⁸, AURORE VAL^{13,7,3}, LEN VAN SCHALKWYK¹⁹ & WILL ARCHER^{20,21,22}

¹ *Austrian Archaeological Institute (ÖAI), Austrian Academy of Sciences, Austria*

² *Human Evolution and Archaeological Sciences (HEAS), University of Vienna, Austria*

³ *Department of Archaeology, School of Geography, Archaeology, and Environmental Studies, University of the Witwatersrand, South Africa*

**Corresponding author. Email: viola.schmid@oeaw.ac.at*

⁴ *Evolutionary Studies Institute (ESI), University of the Witwatersrand, South Africa*

⁵ *Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés (TRACES), University of Toulouse Jean Jaurès, France*

⁶ *Rock Art Research Institute (RARI), School of Geography, Archaeology and Environmental Studies, University of the Witwatersrand, South Africa*

⁷ *Interdisciplinary Center for Archaeology and Evolution of Human Behaviour (ICArEHB), Universidade do Algarve, Portugal*

⁸ *TraceoLab/Prehistory, University of Liège, Belgium*

⁹ *Fonds National pour la Recherche Scientifique (F.R.S.-FNRS), University of Liège, Belgium*

¹⁰ *Origins Centre, University of the Witwatersrand, South Africa*

¹¹ *Human Evolution Research Institute, University of Cape Town, South Africa*

¹² *Department of Prehistoric and Historical Archaeology, University of Vienna, Austria*

¹³ *CNRS, Laboratoire Méditerranéen de Préhistoire Europe Afrique (LAMPEA), Aix-Marseille University, France*

¹⁴ *Université Côte d'Azur, CNRS, Cultures et Environnements. Préhistoire, Antiquité, Moyen Âge (CEPAM), France*

¹⁵ *Department of Evolutionary Anthropology, University of Vienna, Austria*

¹⁶ *Department of Anatomy and Biomechanics, Division of Biomechanics, Karl Landsteiner University of Health Sciences, Krems, Austria*

¹⁷ *NT, CNRS, Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés (TRACES), University of Toulouse Jean Jaurès, France*

¹⁸ *CNRS, Archéosciences Bordeaux, University of Bordeaux Montaigne, France*

¹⁹ *eThembeni Cultural Heritage Management, Ashburton, South Africa*

²⁰ *Department of Archaeology, National Museum Bloemfontein, South Africa*

²¹ *Max Planck Africa Partner Group, Department of Human Origins, Max Planck Institute for Evolutionary Anthropology, Germany*

²² *Department of Geology, University of the Free State, South Africa*

(Received August 2024. Revised November 2024)

ABSTRACT

Rose Cottage Cave is widely recognised as a key sequence for the Middle Stone Age and Later Stone Age in the southern African central interior, with its unique palaeoenvironmental and chrono-cultural archive spanning a semi-continuous record from the Late Pleistocene to the 19th century. Building on important previous research, new excavations will extend our knowledge concerning technological systems, landscape use, human-environment interactions, as well as site formation and the linkages between these parameters in a regional context. Here we report on preliminary insights from the recent fieldwork and provide an overview of future directions.

Keywords: South Africa, Grassland Biome, Middle & Later Stone Age, hunter-gatherer behaviours, palaeoenvironment, rock art, lithic technology

INTRODUCTION

The site of Rose Cottage Cave (eastern Free State, South Africa) is located at an altitude of 1676 m asl in the Grassland Biome of the western foothills of the Maloti-Drakensberg mountain range (Fig. 1). Rose Cottage Cave has a unique, well-stratified long sequence and, with the exception of Ntloana Tšoana (Mitchell & Steinberg 1992) and Ha Makotoko (Dewar *et al.* 2024), Lesotho, is the only known rock shelter site in the region to encompass substantial Later Stone Age (LSA) and Middle Stone Age (MSA) occupational pulses (Fig. 2). These include pulses from marine isotope stage (MIS) 5, the so-called pre-Howiesons Poort, as well as MIS4 and 3 phases that include the Howiesons Poort, post-Howiesons Poort and the final/terminal MSA (Wadley 1997, 2023).

The initial fieldwork by Malan (1952) in the 1940s revealed the importance of the site. Malan excavated a large area in the eastern part of the rock shelter but removed only five squares to bedrock at a depth of approximately 7 m (Fig. 3) (Wadley & Harper 1989; Wadley 1991). He used an imperial unit system and excavated in 3-inch spits (Wadley & Harper 1989). The well-known French archaeologist, Abbé Henri Breuil, participated in Malan's excavations in 1943 and 1944. Besides copying and interpreting the rock art (Breuil 1944), Breuil was the first to identify a then unknown

bladelet industry at Rose Cottage Cave that he claimed should be considered as new in the southern Africa chrono-cultural sequence. It was not until the 1970s, however, that this bladelet technology was officially recognised at the site of Nelson Bay Cave and named the Robberg technocomplex (Wadley 1996).

In 1962, Beaumont (1978) launched excavations at Rose Cottage Cave to collect material for radiocarbon dating. The very first radiocarbon date from the top-standard laboratory established by John Vogel at the Council for Scientific and Industrial Research in Pretoria, Pta-0001, was sampled from the MSA of Rose Cottage Cave (Vogel & Marais 1971). Several following radiocarbon dates established the antiquity of the Rose Cottage Cave sequence (Beaumont 1978).

From 1987 to 1998, Lyn Wadley (1997) resumed excavations at Rose Cottage Cave as part of a research programme aiming to resolve the chronology and reconstruct palaeoenvironments, cultural shifts and organisational use of space within the site. The Wadley team excavated from the uppermost LSA deposits to the final/terminal MSA layers. A new metric grid was established, retaining the imperial system where it adjoined the Malan and Beaumont excavations (Wadley 1997). Philip T. Harper, a master's student of Wadley, conducted fieldwork between 1989 and 1991 focusing on nine square yards in which the MSA had been already exposed by Malan's excavation. He excavated those squares to bedrock (Fig. 3) (Harper 1994, 1997). The publication of numerous studies on different aspects of the site followed (see Wadley 1997, 2023, and references therein). It was the first southern African site where residue analysis was conducted on lithics (Williamson 1997, 2000a; Gibson *et al.* 2004) and where chemical tests were conducted on rock art (Williamson 2000b).

The basal layer, dating to MIS5, contains a small sample of lithics informally termed pre-Howiesons Poort (Harper 1997). Lombard and colleagues (2012) assigned this assemblage of Rose Cottage Cave together with the one from Sibhudu Cave (KwaZulu-Natal) to the pre-Still Bay technocomplex dating to MIS4 and MIS5. These informal designations lack clear typo-technological characteristics and call for new investigations. Today, more than 25 years after the first description, the study of the pre-Howiesons Poort assemblage along with data from new excavations at Rose Cottage Cave comprise an integral part of the project, Time of Essential Changes in Human History (TECH), which explores cultural dynamics in the MSA during MIS5. Renewed fieldwork at Rose Cottage Cave not only aims to employ newly available archaeological science methods, but also reignites research interest within the broader region of the eastern Free State. Currently, we collaborate as an international, multidisciplinary team, endeavouring to deepen our understanding of diachronic variability at Rose Cottage Cave. Our focus extends beyond archaeological investigation; we seek to elucidate Rose Cottage Cave's significance as a cultural locus, and to unravel its specific significance for past inhabitants.

OBJECTIVES AND OUTLOOK

Our goals concern several research dimensions detailed below. We include the legacy collections from previous excavations while focusing on new collections from the recent field campaign. Our interdisciplinary suite of approaches explores evidence of cultural traditions, subsistence strategies, and mobility patterns during key occupational pulses which we contextualise within palaeoenvironmental changes, and the taphonomic history of Rose Cottage Cave. This work will contribute substantially to refining the chrono-cultural framework of the southern African Stone Age.

Lithic characterisation and provenance analysis will be performed in accordance with the Multi Layered Chert Sourcing Approach (MLA) (Brandl *et al.* 2018) to trace artefacts back to their geological source areas and draw conclusions about resource management. This method integrates visual pregrouping, followed by microfacies analysis to test group consistency and geochemistry (LA-ICP-MS) as well as spectroscopy (FTIR) for trace element and microstructural determination. This avenue comprises the first application of this workflow for archaeological siliceous rock sourcing in southern Africa.

A novel combination of technological and techno-functional studies will tackle questions on blank production, tool manufacture and design within different technocomplexes, particularly the pre-Howiesons Poort, the Robberg (Fig. 4), and the Wilton (Fig. 5), and will be enriched by comparisons with penecontemporaneous sites in the region to address knowledge transfer. The further study of the Wilton will proceed from the recently published results on the Classic Wilton layer (Guillemard 2024) to the comparison of the mid-Holocene lithic assemblage with the late Holocene assemblages dated to before and after the appearance of pottery at the site, with the broader aim of understanding new subsistence economies in South Africa from around two thousand years ago and their implications for change and continuity in material culture.

A functional study focusing on MSA lithics will benefit from the latest methods of residue analysis and the upcoming geoarchaeological and palaeoenvironmental data, and will provide an updated view on stone tool residue preservation at Rose Cottage Cave. It will be coupled with a use-wear study that expands the scope of functional considerations from projectile points (Villa & Lenoir 2006; Soriano *et al.* 2007) to different subsistence, processing, and craft activities. It will evaluate how they shaped the Howiesons Poort and post-Howiesons Poort lithic industries, paying particular attention to the influence of local raw material availability on lithic technology.

Ochre and rock art research will pursue several lines of inquiry. New work will follow previous analyses of the large MSA ochre assemblage from Rose Cottage Cave (Watts 1998; Hodgskiss & Wadley 2017) and on paint analysis by Williamson (2000b). Ochre and ochre processing tools will be studied in the transitional MSA/LSA layer and LSA layers and we will investigate continuities and/or changes in ochre use over time. First efforts will be made to identify local and non-

local sources of ochre with the help of physical and geochemical characterisation to gain further insight into mobility patterns and links between Rose Cottage Cave and other sites.

Rose Cottage Cave's rock paintings belong to at least two relative phases of image-making in the wider region: older shaded polychromes and younger unshaded or hard-edged images (Witelson 2023). New documentation, direct dating and chemical analyses to determine accurate paint compositions will improve our understanding of the site's depictions which, as noted above, have been previously analysed chemically (Williamson 2000b), but mostly interpreted in social terms using San (Bushman) hunter-gatherer ethnography (Ouzman 1995, 1997; Ouzman & Wadley 1997). New analyses will also shed light on raw material sources and social elements like movement and trade.

We will tackle questions related to palaeoenvironment and hunter-gatherer responses through a new suite of methods sensitive to the preservation conditions at Rose Cottage Cave. Archaeological soil micromorphology (Courty *et al.* 1989; Stoops 2021) will be used to reconstruct site formation processes. This work will build on an unpublished master's thesis (Kloos 2014) which used sediment peels designed and collected by Wadley. The peels were analysed with the naked eye, a magnifying glass, and a binocular microscope. Subsequently, thin sections were produced. However, due to the limited depth of the impregnation of the peels, the resulting thin sections preserved only parts of the sedimentary sequence. Our renewed efforts are directed at comprehensive sampling of the site, including for sedaDNA, to understand the macroscopically variable nature of the deposits, assess the integrity of the archaeological assemblage, identify palaeoenvironmental markers, and to examine the nature of the anthropogenic sedimentary signature.

Previous excavations at Rose Cottage Cave yielded abundant LSA faunal remains reflecting a cold and humid period during the Robberg, followed by warmer temperatures and greater aridity during the Oakhurst (Plug & Engela 1992). A new comprehensive taphonomic analysis of the LSA faunal remains integrating site formation data will further evaluate the modalities of bone accumulation at the site and build upon existing reconstructions of human subsistence strategies. Combined with new high-resolution palaeoecological reconstructions from microfauna (Avery 1997), we will explore plant and animal community changes around Rose Cottage Cave during the Pleistocene/Holocene transition, and hunter-gatherer responses. The relationship between our new estimates of past climatic variables and potential changes in resource availability and human cultural expression during the LSA will be explored broadly.

For the MSA sequence where faunal remains are not preserved, botanical remains are critical palaeoenvironmental proxies. New charcoal samples will complement the previously gathered data (e.g. Esterhuysen 1996; Lennox & Wadley 2022), and tackle the recently exposed combustion features (see Excavation 2023) with the aim of providing insights into particular fire activities that can be inferred from the wood selection and/or the supply area. We will also exploit the higher preservation

potential of phytoliths compared to pollen in acidic sediments in South Africa (e.g. Esteban *et al.* 2018), and explore the interpretative potential of these micro-remains for reconstructing early human plant use and site use patterns as well as past vegetation, landscapes and climates at Rose Cottage Cave.

In addition, we will test for the preservation of biomarkers that can shed light on hydroclimate and vegetation in rock shelter settings (e.g. Roberts *et al.* 2013; Collins *et al.* 2017; Patalano *et al.* 2023) to determine the content of the organic matter at Rose Cottage Cave.

The collaborative investigations into human occupation at Rose Cottage Cave will be supported by new dating efforts to improve site chronology. Various methods have been previously applied to date the occupation layers at Rose Cottage Cave, including radiocarbon (e.g. Wadley & Vogel 1991; Loftus *et al.* 2019), OSL on sedimentary quartz grains, IRSL on sedimentary feldspar grains, and TL on burnt lithics (e.g. Woodborne & Vogel 1997; Valladas *et al.* 2005; Jacobs *et al.* 2008; Pienaar *et al.* 2008) (Fig. 2). The 77 ages currently available range from the last millennium to *c.* 100 ka BP with a potential hiatus observed between 35 and 50 ka BP. However, the internal uncertainty of each applied method and different assumptions (e.g. on the past mean water content) made by the various dating teams have led to a considerable age scatter within units (Fig. 2). The age of the lowest units (Lendrum [LEN] especially) remains poorly constrained. New luminescence dating in particular aims to clarify the timeframe of the aforementioned layers.

Ongoing re-excavations at Rose Cottage Cave took place in 2024, and we intend to continue surveying the surroundings of the site for lithic and ochre raw material sources and exploring the potential of the area for further archaeological investigations.

PRELIMINARY RESULTS

RAW MATERIAL SURVEY

Results of our raw material surveys in 2023 and early 2024 as well as the initial characterisation of the pre-Howiesons Poort lithics from Rose Cottage Cave and their comparison with geological samples suggest high congruence between the artefacts and regionally available resources (Fig. 6).

The main objective of the raw material survey was to identify the provenance and potential deposits of a particular lithic raw material group formerly referred to as ‘opaline’ (see Wadley 1997; Soriano *et al.* 2007). Initial microscopic investigations revealed that this group consists of chalcedonies, agates and potentially, silicates with bioclastic content. The closest possible sources of visually corresponding materials can be found in secondary deposits along the old terraces of the nearby Caledon River. Furthermore, it was of interest to know where potential primary deposits of this kind of material could be recognised, and if these sources could have been used by the Stone Age inhabitants of Rose Cottage Cave, either by self-supply or via exchange with other groups. The direct

geological supply zone of the Caledon River is found within the mountainous regions of western Lesotho, which was consequently included into our survey activities. In 2024, we visited Morija to gain an impression of the primary outcrops in the region. We plan to collect samples in the same area during the next field season after acquiring a permission from Lesotho's Department of Culture.

The immediate surroundings of Rose Cottage Cave were also investigated intensively to obtain samples of silicified components within the local sandstone of the Clarens Formation hosting Rose Cottage Cave. Several sample locations suggest evidence for partly decimetre-thick layers of silicified sandstone, which corresponds macroscopically and microscopically to a raw material group identified in the pre-Howiesons Poort lithic assemblage. A characteristic feature of the local, sub-primary deposits formed through erosion and collapse of the sandstone cliff is a distinct structure developing on the surfaces of silicified sandstone layers exposed to weathering. This might have been a visual indicator for past people to recognise rocks suitable for stone tool production. Another locally available raw material is hornfels, which can be found in small riverbeds and in dongas cut into the sandstone formation.

The extended field and laboratory work demonstrates the potential of systematic analytical protocols to identify the main local, regional and supra-regional sources of the lithic raw material that supplied the occupants of Rose Cottage Cave.

EXCAVATION 2023

Fieldwork at Rose Cottage Cave thus far has devised a new measuring grid, curated the site, exposed former excavation areas, and documented the shelter photogrammetrically. Our first aim was to base our new measuring system on Wadley's metric quadrant grid. Old markings, such as the attachment points of wires and strings on the cave walls, labelling of squares on the cave walls, and the local height reference point highlighted with a white horizontal line on the boulder in the north, allowed us to reconstruct the location of the Wadley system. Only the corner points of the individual squares had to be reconstructed. This was accomplished with coordinate recording by a total station in the shelter and shifting the data in the programme AutoCAD to the position exactly overlapping with the Wadley metric system (Fig. 3).

3D photogrammetry was used to create a 3D model of the cave, to document the shelter's rock paintings in high resolution (Fig. 7) and to record the positions of the profiles and surfaces of previous excavations precisely. The unfavourable lighting conditions and the considerable size of the rock shelter turned out to be a big challenge. Nevertheless, careful planning and execution of the image acquisition and the use of datums for georeferencing, which are fundamental for the accuracy and reliability of the data, as well as the use of a six-metre-high telescopic carbon monopod to reach most areas and keep relative consistency between camera and object helped to achieve the objectives. The

processing and generation of the photogrammetric models in the software Agisoft Metashape involved a total of 1688 individual photos.

Besides the profiles, we additionally exposed and cleaned the final excavation floor where the Wadley excavation had stopped in February 1998. The last stratigraphic unit reached in different squares was either Geoff (Ge) or Sven (Sv), which is confirmed by the excavation documentation based in the collection archives of the Department of Archaeology at the University of the Witwatersrand. The final MSA layers Daniel Yellow (Dy) stratigraphically above Pavement (P) and Geoff (Ge) are dated to between 30 and 32 ka BP (Wadley & Vogel 1991; Pienaar *et al.* 2008). Published data are available for Dy. This layer exhibits a low artefact density, a paucity of retouched elements with clear MSA character though, including backed pieces (Wadley 1991, 1997; Harper 1994), and refits (Allott 2000; Wadley 2004, 2006). However, numerous combustion features, overlapping or within a few centimetres of one another, are present. The largest ones have a depth up to 20 cm, while several tiny pits of 20 cm width and 5 cm depth as well as ash smears occur. The hearth features are commonly flat and have no stone surroundings. The seemingly randomly distributed combustion features suggest repeated new installation rather than reuse. Moreover, the clustering of lithics and refits mostly around the hearths indicate more of an unstructured camp layout than specific activity areas (Wadley 2004, 2006). We identified 22 features on the uncovered excavation floor. The majority are relatively shallow and have a diameter between 5 and 30 cm. Feature 01 in square K3 was outstanding as it showed an *in situ* stone arrangement (Fig. 8). This feature was already recognised during the last days of the Wadley excavation but no mention of associated fragmented slabs of stone was made. However, the documentation from the Wadley excavation confirms that Feature 01 together with Feature 02 seemingly correspond to layer Ge and raises questions about similar structuring of space through the final MSA, and the meaning of different constructions in terms of activities and wood fuel management.

Block samples of sediment were taken from the lowermost deposits for OSL dating and micromorphological studies (Fig. 9).

ROCK ART

New digital photography for image enhancements in DStretch and the LAB colour space, and for the purposes of photogrammetry at Rose Cottage Cave, has yielded several preliminary findings. With the excavation having removed most of the original floor, the rock art has to be viewed from below the original surface and at some distance. To address this, we used a WiFi-capable DSLR camera on a 6-metre monopod to capture high-resolution images that await further study. The large entrance boulder limits natural light, making daytime visibility poor, although it is better in winter. In 2023, night-time sampling for OSL dating revealed that LED lights mimicking sunlight (designed by Chris Thornhill) provide optimal viewing conditions.

Initial results relate to the spatial interpretation of the painted rock shelter by Ouzman (1997). Ouzman (1997) analysed the site's rock art through San idioms of supernatural potency and shamanistic activities. He examined the distribution of the rock art, finding that most images are on the eastern and southern walls (Fig. 7) where they survived due to the inward-sloping angles of the walls that prevented dust accumulation. Ouzman (1997) proposed that the exclusive placement of paintings on the eastern and southern walls reflected social organisation and use of space. He suggested that the crack separating these walls would have been significant in San thought (Fig. 10a) and that the contrasting painted themes on the two painted walls concerned appropriate behaviour during aggregation phases. This interpretation is based on the visibility of the paintings on the eastern and southern walls as one enters the site from either side of the boulder. Ouzman's (1997) interpretation may need revision because the crack between the eastern and southern walls (Fig. 10a) is mirrored by a similar crack between the western and northern (the boulder) walls (Fig. 10b). Additionally, we have discovered a few poorly preserved images on the western wall evidencing that it was once painted. The northern wall also contains remnants of images near the eastern entrance, despite being convex and covered in dust and guano. Our findings have also revealed that there are more human figures at the site than appear in the previous documentation (Fig. 11), although there can be no doubt that they were seen by earlier workers. A detailed study of these figures in the future will provide a clearer understanding of the extent of the painted groups and the activities in which they are engaged.

The number of ichthyoid/cetacean motifs is inconsistent in the published record: Ouzman (1995) reports six, Breuil (1944) published four and copied eight (available online at www.sarada.co.za), while our count is eight (Fig. 12), excluding two that are shown in Breuil's copies and which we have not found again on the rock surface. Despite their relatively large size compared to other fish depictions in the eastern Free State, the motifs lack diagnostic features: five of the eight images are missing fins. The monochromatic silhouettes complicate identification. It is unclear whether the animals are shown from an aerial, lateral, or twisted perspective. This distinction is crucial since the plane of fish and shark tails is typically perpendicular to the ground surface, while cetacean tails are parallel. Ouzman (1995, 1997) interpreted the 'lobe' near the head of one ichthyoid motif as the 'proboscis' of a mormyrid (Fig. 12c). However, this image could also be construed as a cetacean in twisted perspective with its head turned away from the viewer and one of the two flippers extending over the back line. Similarly, the second fish from the top in Fig. 12d could be said to have an adipose fin, but the shape and position of this feature might have been accidental. Without additional information, determining the genus or species of these aquatic motifs is unfeasible. While Ouzman's (1995) work on mormyrids in San rock art and belief remains useful, the identification of one at Rose Cottage Cave is ambiguous.

TECHNOLOGICAL INSIGHTS INTO THE PRE-HOWIESONS POORT

The basal layer LEN has been informally termed as ‘pre-Howiesons Poort’, and Wadley and Harper (1989) and Harper (1994, 1997) provided the first typological descriptions. Soriano *et al.* (2007) performed a preliminary technological analysis in addition to their technological study of the Howiesons Poort and post-Howiesons Poort. These scientific works claim that the assemblages from layers Küsel A (KUA) and Küsel B (KUB) situated directly above LEN and originally assigned to the pre-Howiesons Poort on stratigraphic grounds would rather represent early Howiesons Poort expressions. They exhibit strong similarities in raw materials and blank production methods but differ drastically from LEN in terms of formal tool assemblage (Harper 1994; Soriano *et al.* 2007). We analysed the small legacy assemblage of LEN in the Harper collection (n = 262) in further detail following the *chaîne opératoire* approach to specify the characteristics of the technical system and to identify possible innovative features.

The assemblage consists of 35.1% blades, 22.1% bladelets, 36.3% flakes (of which 19 are elongated), 3.8% cores, 1.5% angular debris, and 1.1% manuports (Table 1). The tool component is prominent, as 15.4% of the debitage products, primarily blades (n = 28), demonstrate modifications. Corresponding to the blade technology described by Soriano *et al.* (2007), the reduction strategy predominantly pertains to the exploitation of small ‘opaline’ nodules and is oriented towards the continuous production of small blades and bladelets. Although the knappers often used the natural ridges of the nodules to kick off the reduction, cresting played a role in core maintenance as well as initial core preparation. The platforms are commonly thicker than 2 mm and faceting occurs regularly pointing to percussion further away from the core margin. Notably, the sample contains two burin-like artefacts in silicified sandstone that we have interpreted as bladelet cores (Fig. 13A) and that are accompanied with a few burin spalls. Similar blank production strategies have been documented in Europe during younger periods (e.g. Buisson 1991; Brou & Le Brun-Ricalens 2006; Igreja & Pesesse 2006; Klaric 2006; Klaric *et al.* 2009; Le Brun-Ricalens & Brou 2012; Bataille & Conard 2018; Klaric *et al.* 2018). While a detailed functional study is pending, the initial stereomicroscopic examination of the Rose Cottage Cave artefacts revealed no clear damage from use on the burin bits or facet edges, which, together with technological attributes, supports the core interpretation. The formal tools in the sample encompass side-scrapers, notched pieces and a few backed pieces, including one trapeze. However, the most striking elements, already emphasised by Harper (1994, 1997), are the highly diagnostic unifacially retouched or shaped points, of which some exhibit explicit ventral basal thinning (Fig. 13B–C). Similar points have been recognised in the region at Sheppard Island (Van Riet Lowe 1931), Kranskraal (Van Hoepen 1932), Vlakkraal (Wells *et al.* 1942), Lovedale (Wroth *et al.* 2022), and potentially at Modderpoort (Malan 1942).

ACKNOWLEDGEMENTS

We thank the South African Heritage Resources Agency (SAHRA) for issuing the excavation permit; Professor Lyn Wadley, one of the co-authors, for her constant support; Dr Thembi Russell, curator of

the Wits Archaeological Collection, for granting access; Chris Thornhill (Thornhill Field Services) for providing his expertise and installation of lighting; and Irene Petschko, Austrian Archaeological Institute, for creating the map. The TECH project is funded by the Austrian Science Fund (project number T1321) and the functional analysis of lithic tools by the Fund for Scientific Research (F.R.S.-FNRS) (FC 43275 attributed to NT) and by the University of Liège. VCS, MBa, and MBö are grateful to the Austrian Archaeological Institute of the Academy of Sciences for support. SER is supported by ICArEHB funded by the Portuguese Foundation for Science and Technology under program UIDP/04211/2020. The OSL dating is funded under the ANR "The MileStone Age" (ANR-21-CE27-0030-001). We wish to thank the Rose Cottage Cave excavation team 2023, Dragana Perovanovic and Jan Oberholzer, who have contributed significantly to the successful realisation of the project so far. We finally thank the two reviewers who contributed to improve an earlier version of the manuscript.

REFERENCES

- Allott, L.F. 2000. Spatial analysis of YD layer at Rose Cottage Cave near Ladybrand, South Africa. Unpublished Master's dissertation. Johannesburg: University of the Witwatersrand.
- Avery, D.M. 1997. Micromammals and the Holocene environment of Rose Cottage Cave. *South African Journal of Science* 93: 445–448.
- Bataille, G. & Conard, N.J. 2018. Burin-core technology in Aurignacian horizons IIIa and IV of Hohle Fels Cave (Southwestern Germany). *Quartär* 65: 7–49.
- Beaumont, P.B. 1978. Border Cave. Unpublished Master's dissertation. Cape Town: University of Cape Town.
- Brandl, M., Martinez, M.M., Hauzenberger, C., Filzmoser, P., Nymoen P. & Mehler, N. 2018. A multi-technique analytical approach to sourcing Scandinavian flint: Provenance of ballast flint from the shipwreck "Leirvigen 1", Norway. *PLoS ONE* 13(8): e0200647.
- Breuil, H. 1944. Sea animals amongst the prehistoric rock paintings of Ladybrand. *South African Journal of Science* 41: 353–360.
- Bronk Ramsey, C. 2021. Oxcal v4. 4.4 calibration program. Website: <https://c14.arch.ox.ac.uk/oxcal/OxCal.html>.
- Brou, L. & Le Brun-Ricalens, F. 2006. Burins carénés et busqués: des nucléus à lamelles. L'apport des remontages du gisement de Thèmes (Yonne). In: Araujo Igreja, M., Bracco, J-P. & Le Brun-Ricalens, F. (eds) *Burins préhistoriques: formes, fonctionnements, fonctions. Actes de la table ronde internationale organisée du 3 au 5 mars 2003 à la Maison Méditerranéenne des Sciences de l'Homme, Université d'Aix-en-Provence. ArchéoLogiques* 2: 225–238. Luxembourg: Musée National d'Histoire et d'Art.

- Buisson, D. 1991. Le Périgordien du Blot (Cerzat, Haute-Loire): note préliminaire. *Bulletin de la Société préhistorique française* 88: 104–108.
- Collins, J.A., Carr, A.S., Schefuß, E., Boom, A. & Sealy, J. 2017. Investigation of organic matter and biomarkers from Diepkloof Rock Shelter, South Africa: Insights into Middle Stone Age site usage and palaeoclimate. *Journal of Archaeological Science* 85: 51–65.
- Courty, M.A., Goldberg, P. & Macphail, R. 1989. *Soils and Micromorphology in Archaeology*. Cambridge: Cambridge University Press.
- Dewar, G., Zastrow, J., Arthur, C. & Mitchell, P. 2024. A zooarchaeological perspective on late Pleistocene/early Holocene human behaviour in the Maloti-Drakensberg region, southern Africa: the view from Ha Makotoko and Ntloana Tsoana rock-shelters, Lesotho. *Quaternary Science Advances* 13: 100170.
- Esteban, I., Marean, C.W., Fisher, E.C., Karkanas, P., Cabanes, D. & Albert, R.M. 2018. Phytoliths as an indicator of early modern humans plant gathering strategies, fire fuel and site occupation intensity during the Middle Stone Age at Pinnacle Point 5–6 (South coast, South Africa). *PLoS ONE* 13: e0198558.
- Esterhuysen, A.B. 1996. Palaeoenvironmental reconstruction from Pleistocene to present: an analysis of charcoal from sites in the Eastern Free State and Lesotho. Unpublished Master's dissertation. Johannesburg: University of the Witwatersrand.
- Gibson, N.E., Wadley, L. & Williamson, B.S. 2004. Microscopic residues as evidence of hafting on backed tools from the 60 000 to 68 000 year-old Howiesons Poort layers of Rose Cottage Cave, South Africa. *Southern African Humanities* 16: 1–11.
- Guillemard, I. 2024. Exploring Wilton microlithic technologies: New analyses from Rose Cottage Cave, South Africa. *Quaternary Science Reviews* 333: 108679.
- Harper, P.T. 1994. The Middle Stone Age sequence at Rose Cottage Cave: the search for continuity and discontinuity. Unpublished Master's dissertation. Johannesburg: University of the Witwatersrand.
- Harper, P.T. 1997. The Middle Stone Age sequences at Rose Cottage Cave: a search for continuity and discontinuity. *South African Journal of Science* 93: 470–475.
- Hodgskiss, T. & Wadley, L. 2017. How people used ochre at Rose Cottage Cave, South Africa: sixty thousand years of evidence from the Middle Stone Age. *PLoS ONE* 12: e0176317.

Hogg, A.G., Heaton, T.J., Hua, Q., Palmer, J.G., Turney, C.S.M., Southon, J., Bayliss, A., Blackwell, P.G., Boswijk, G., Bronk Ramsey, C., Pearson, C., Petchey, F., Reimer, P., Reimer, R. & Wacker, L. 2020. SHCal20 Southern Hemisphere calibration, 0–55,000 years cal BP. *Radiocarbon* 62: 759–778.

Igreja, M. & Pesesse, D. 2006. Entre modalités techniques et objectifs fonctionnels: les burins de l'unité OP10 de la Vigne Brun (Villerest, Loire, France). In: Araujo Igreja, M., Bracco, J-P. & Le Brun-Ricalens, F. (eds) *Burins préhistoriques: formes, fonctionnements, fonctions. Actes de la table ronde internationale organisée du 3 au 5 mars 2003 à la Maison Méditerranéenne des Sciences de l'Homme, Université d'Aix-en-Provence. ArchéoLogiques* 2: 165–196. Luxembourg: Musée National d'Histoire et d'Art.

Jacobs, Z., Roberts, R.G., Galbraith, R.F., Deacon, H.J., Grün, R., Mackay, A., Mitchell, P., Vogelsang, R. & Wadley, L. 2008. Ages for the Middle Stone Age of southern Africa: implications for human behavior and dispersal. *Science* 322: 733–735.

Klaric, L. 2006. Des armatures aux burins: des critères de distinction techniques et culturels à partir des productions lamellaires de quelques sites du Gravettien moyen et récent (France). In: Araujo Igreja, M., Bracco, J-P. & Le Brun-Ricalens, F. (eds) *Burins préhistoriques: formes, fonctionnements, fonctions. Actes de la table ronde internationale organisée du 3 au 5 mars 2003 à la Maison Méditerranéenne des Sciences de l'Homme, Université d'Aix-en-Provence. ArchéoLogiques* 2: 199–224. Luxembourg: Musée National d'Histoire et d'Art.

Klaric, L., Bertran, P., Dumarçay, G. & Liard, M. 2018. A long and winding road: towards a palethnographic interpretation of the middle-Gravettian site of la Picardie (Indre-et-Loire, France). *Quaternary International* 498: 51–68.

Klaric, L., Guillermin, P. & Aubry, T. 2009. Des armatures variées et des modes de production variable. Réflexions à partir de quelques exemples issus du Gravettien d'Europe occidentale (France, Portugal, Allemagne). *Gallia Préhistoire* 51: 113–154.

Kloos, P. 2014. 'Geoarchaeological Investigations of Sediment Peels from Rose Cottage Cave, South Africa'. Unpublished Master's dissertation. Tübingen: Eberhard-Karls-Universität Tübingen.

Le Brun-Ricalens, F. & Brou, L. 2012. Kielkratzer und Kielstichel: Werkzeug vs. Lamellenkern. In: Floss, H. (ed.) *Steinartefakte. Vom Altpaläolithikum bis in die Neuzeit*: 341–356. Tübingen: Kerns Verlag.

Lennox, S. & Wadley, L. 2022. Middle Stone Age wood use in Rose Cottage Cave South Africa: evidence from charcoal identifications. *Quaternary International* 611–612: 102–114.

- Loftus, E., Pargeter, J., Mackay, A., Stewart, B.A. & Mitchell, P. 2019. Late Pleistocene human occupation in the Maloti-Drakensberg region of southern Africa: new radiocarbon dates from Rose Cottage Cave and inter-site comparisons. *Journal of Anthropological Archaeology* 56: 101117.
- Malan, B.D. 1942. The Middle Stone Age of the upper Caledon River Valley: the Modderpoort Culture: *Transactions of the Royal Society of South Africa* 29: 113–127.
- Malan, B.D. 1952. The final phase of the Middle Stone Age in South Africa. In: *Proceedings of the Pan-African Congress on Prehistory, Nairobi, 1947*: 188–194. New York: Philosophical Library.
- Mitchell, P. & Steinberg, J.M. 1992. Ntloana Tsoana: a Middle Stone Age sequence from western Lesotho. *South African Archaeological Bulletin* 47: 26–33.
- Ouzman, S. 1995. The fish, the shaman and the peregrination: San rock paintings of mormyrid fish as religious and social metaphors. *Southern African Field Archaeology* 4: 3–17.
- Ouzman, S., 1997. Hidden in the common gaze: collective and idiosyncratic rock paintings at Rose Cottage Cave, South Africa: introduction. *Navorsing van die Nasionale Museum: Researches of the National Museum* 13(6): 226–255.
- Ouzman, S. & Wadley, L. 1997. A history in paint and stone from Rose Cottage Cave, South Africa. *Antiquity* 71: 386–404.
- Patalano, R., Arthur, C., Carleton, W.C., Challis, S., Dewar, G., Gayantha, K., Gleixner, G., Ilgner, J., Lucas, M., Marzo, S., Mokhachane, R., Pazan, K., Spurite, D., Morley, M.W., Parker, A., Mitchell, P., Stewart, B.A. & Roberts, P. 2023. Ecological stability of Late Pleistocene-to-Holocene Lesotho, southern Africa, facilitated human upland habitation. *Communications Earth & Environment* 4: 1–12.
- Pienaar, M., Woodborne, S. & Wadley, L. 2008. Optically stimulated luminescence dating at Rose Cottage Cave. *South African Journal of Science* 104(1): 65–70.
- Plug, I. & Engela, R. 1992. The macrofaunal remains from recent excavations at Rose Cottage Cave, Orange Free State. *South African Archaeological Bulletin* 47: 16–25.
- Porraz, G., Texier, P-J., Archer, W., Piboule, M., Brugal, J-P. & Tribolo, C. 2013. Technological successions in the Middle Stone Age sequence of Diepkloof Rock Shelter, Western Cape, South Africa. *Journal of Archaeological Science* 40(9): 3376–3400.
- Roberts, P., Lee-Thorp, J.A., Mitchell, P. & Arthur, C. 2013. Stable carbon isotopic evidence for climate change across the late Pleistocene to early Holocene from Lesotho, southern Africa. *Journal of Quaternary Science* 28: 360–369.

Soriano, S., Villa, P. & Wadley, L. 2007. Blade technology and tool forms in the Middle Stone Age of South Africa: the Howiesons Poort and post-Howiesons Poort at Rose Cottage Cave. *Journal of Archaeological Science* 34(5): 681–703.

Stoops, G. 2021. *Guidelines for Analysis and Description of Soil and Regolith Thin Sections*. Hoboken, NJ: John Wiley & Sons.

Valladas, H., Wadley, L., Mercier, N., Froget, L., Tribolo, C., Reyss, J.L. & Joron, J.L. 2005. Thermoluminescence Dating on burnt lithics from Middle Stone Age layers at Rose Cottage Cave. *South African Journal of Science* 101: 169–74.

Van Hoepen, E.C.N. 1932. Die Mosselbaaise Kultuur. *Argeologiese Navorsing van die Nasionale Museum Bloemfontein* 1: 27–54.

Van Riet Lowe, C. 1931. A Rare Point from Sheppard Island. *Transactions of the Royal Society of South Africa* 20: 57–58.

Villa, P. & Lenoir, M. 2006. Hunting weapons of the Middle Stone Age and the Middle Palaeolithic: spear points from Sibudu, Rose Cottage and Bouheben. *Southern African Humanities* 18: 89–122.

Vogel, J.C. & Marais, M. 1971. Pretoria radiocarbon dates I. *Radiocarbon* 13(2): 378–394.

Wadley, L. 1991. Rose Cottage Cave: background and a preliminary report on the recent excavations. *South African Archaeological Bulletin* 46: 125–130.

Wadley, L. 1996. The Robberg Industry of Rose Cottage Cave, eastern Free State: the technology, spatial patterns and environment. *South African Archaeological Bulletin* 51(164): 64–74.

Wadley, L. 1997. Rose Cottage Cave: archaeological work 1987 to 1997. *South African Journal of Science* 93: 439–44.

Wadley, L. 2000. The Wilton and pre-ceramic post-classic Wilton Industries at Rose Cottage Cave and their context in the South African sequence. *South African Archaeological Bulletin* 55: 90–106.

Wadley, L. 2004. Late Middle Stone Age spatial patterns in Rose Cottage Cave, South Africa. In: Conard, N.J. (ed.) *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age II*: 23–36. Tübingen: Kerns Verlag.

Wadley, L. 2006. The use of space in the Late Middle Stone Age of Rose Cottage Cave, South Africa. In: Hovers, E. & Kuhn, S.L. (eds) *Transitions Before the Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age. Interdisciplinary Contributions to Archaeology*: 279–294. Boston: Springer.

- Wadley, L. 2023. Rose Cottage Cave, South Africa. In: Beyin, A., Wright, D.K., Wilkins, J. & Olszewski, D.I. (eds) *Handbook of Pleistocene Archaeology of Africa: 1653–1662*. Cham: Springer.
- Wadley, L. & Harper, P.T. 1989. Rose Cottage Cave revisited: Malan's Middle Stone Age collection. *South African Archaeological Bulletin* 44: 23–32.
- Wadley, L. & Vogel, J. 1991. Recent dates from Rose Cottage Cave. *South African Journal of Science* 87: 605–608.
- Watts, I. 1998. The origin of symbolic culture: the Middle Stone Age of southern Africa and Khoisan ethnography. Unpublished PhD thesis. London: University College, London.
- Wells, L.H., Cooke, H.B.S. & Malan, B.D. 1942. The associated fauna and culture of the Vlakakraal Thermal Springs. O.F.S. Introduction. II. The Stone Age Industry. III. The Faunal Remains. *Transactions of the Royal Society of South Africa* 29: 203–233.
- Williamson, B.S. 1997. Down the microscope and beyond: microscopy and molecular studies of stone tool residues and bone samples from Rose Cottage Cave. *South African Journal of Science* 93: 458–464.
- Williamson, B.S. 2000a. Prehistoric stone tool residue analysis from Rose Cottage Cave and other southern African sites. Unpublished PhD thesis. Johannesburg: University of the Witwatersrand.
- Williamson, B.S. 2000b. Direct testing of rock painting pigments for traces of haemoglobin at Rose Cottage Cave, South Africa. *Journal of Archaeological Science* 27: 755–762.
- Witelson, D.M. 2023. *Theatres of Imagery: A Performance Theory Approach to Rock Art Research*. Oxford: BAR Publishing.
- Woodborne, S. 1999. Dating the Middle Stone Age in South Africa (National Research Foundation Final Report No. 15/1/3/2/00231). Pretoria.
- Woodborne, S. & Vogel, J.C. 1997. Luminescence dating at Rose Cottage Cave: a progress report. *South African Journal of Science* 93: 476–478.
- Wroth, K., Tribolo, C., Bousman, C.B., Horwitz, L.K., Rossouw, L., Miller, C.E. & Toffolo, M.B. 2022. Human occupation of the semi-arid grasslands of South Africa during MIS4: new archaeological and paleoecological evidence from Lovedale, Free State. *Quaternary Science Reviews* 283: 107455.

[TABLE]

TABLE 1. *Rose Cottage Cave: Frequency of technological categories per raw material*

Raw material/ technological category	Blade		Bladelet		Flake		Core		Angular debris		Manuport		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
Silicate with bioclastic content	38	32.5%	36	30.8%	36	30.8%	3	2.6%	2	1.7%	2	1.7%	117
Silicified sandstone	42	45.7%	12	13.0%	34	37.0%	3	3.3%	1	1.1%	-	0.0%	92
Chalcedony	6	19.4%	7	22.6%	14	45.2%	3	9.7%	-	0.0%	1	3.2%	31
Agate	1	20.0%	2	40.0%	1	20.0%	-	0.0%	1	20.0%	-	0.0%	5
Hornfels	1	33.3%	-	0.0%	2	66.7%	-	0.0%	-	0.0%	-	0.0%	3
Quartzite	1	50.0%	-	0.0%	1	50.0%	-	0.0%	-	0.0%	-	0.0%	2
Quartz	-	0.0%	-	0.0%	-	0.0%	1	0.0%	1	50.0%	-	0.0%	2
Sandstone	-	0.0%	-	0.0%	-	0.0%	2	100.0%	-	0.0%	-	0.0%	2
Petrified/silicified wood	-	0.0%	-	0.0%	1	50.0%	-	0.0%	-	0.0%	1	50.0%	2
Undetermined	2	33.3%	1	16.7%	3	50.0%	-	0.0%	-	0.0%	-	0.0%	6
Total	91	34.7%	58	22.1%	92	35.1%	12	4.6%	5	1.9%	4	1.5%	262

[FIGURES]

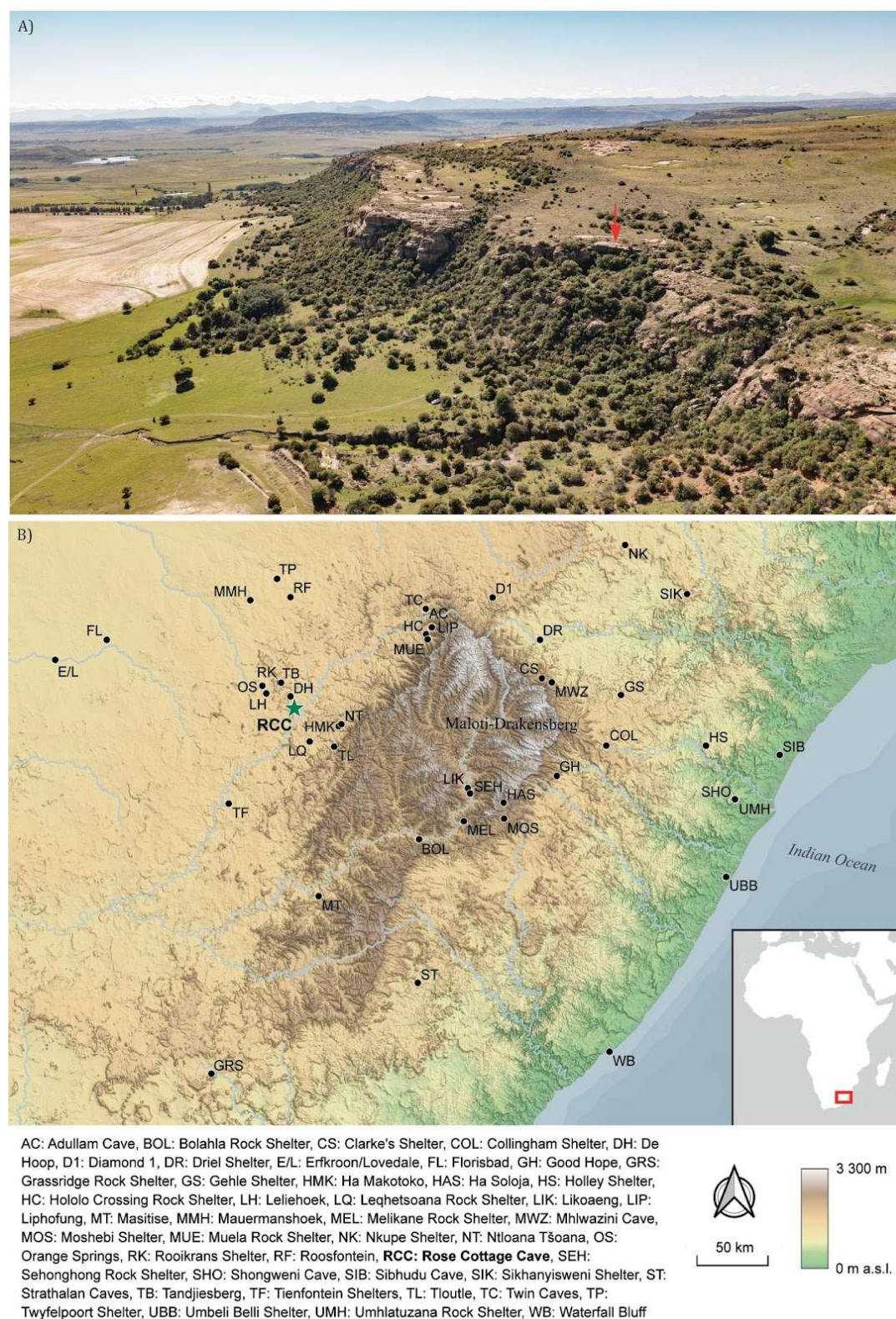


FIG. 1. A) Drone image of Rose Cottage Cave (photo by M. Börner); B) Location of Rose Cottage Cave and other Stone Age sites in the region (map by I. Petschko).

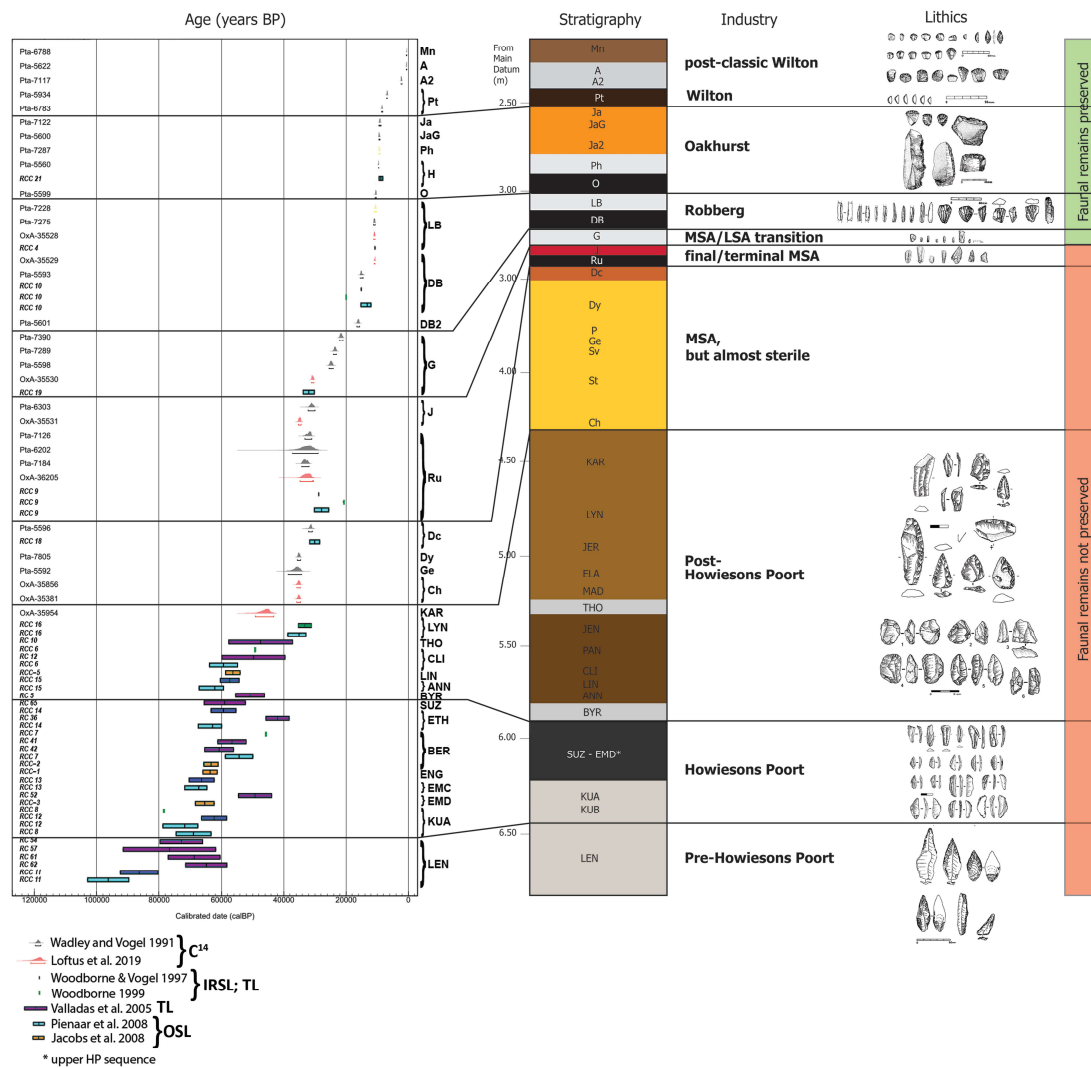
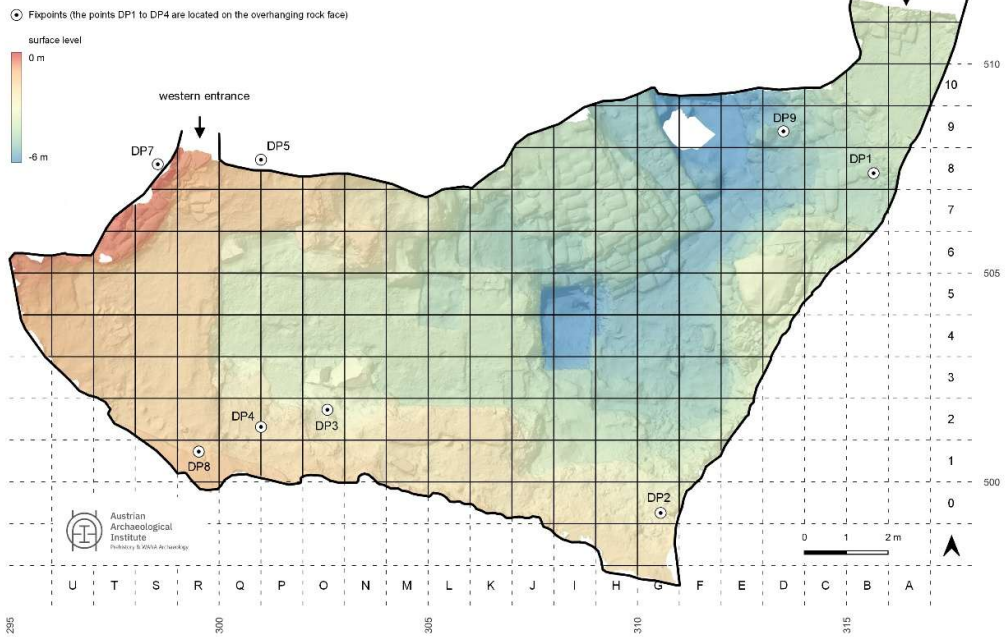


FIG. 2. Chronology and schematic cultural sequence of Rose Cottage Cave. Radiocarbon dates were calibrated using the SHCal20 calibration curve (Hogg *et al.* 2020) and OxCal v4.4.4 software (Bronk Ramsey 2021).

A)

Rose Cottage Cave 2023 | cave floor, digital elevation model and reconstructed excavation grid



B)

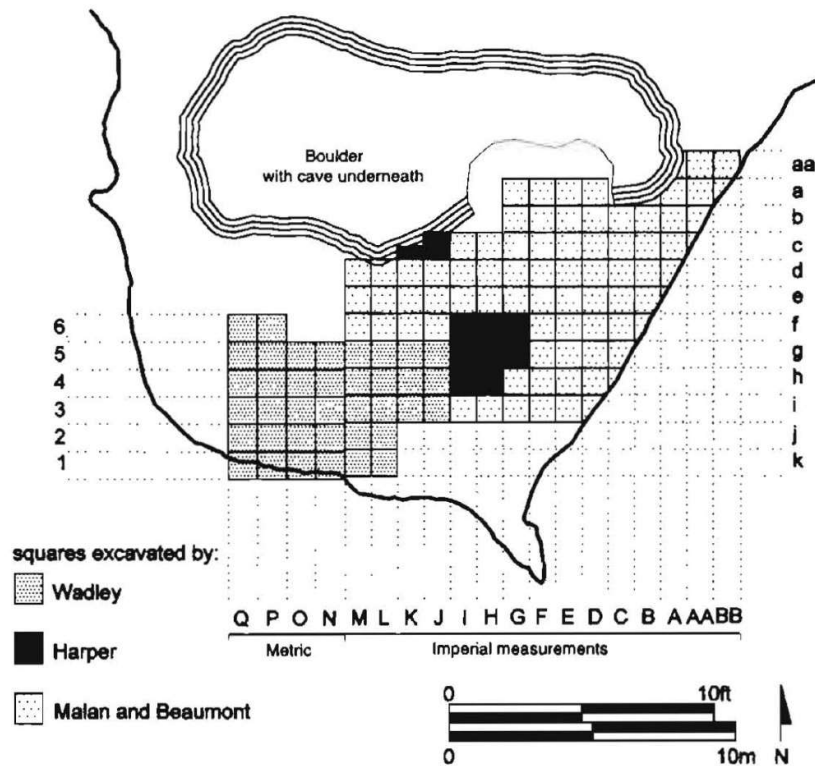


FIG. 3. A) Photogrammetric plan of Rose Cottage Cave showing the new excavation grid and fixpoints (figure by M. Börner) adjusted to B) Wadley's metric grid (Hodgskiss & Wadley 2017).



FIG. 4. Bladelets from the Robberg of Rose Cottage Cave (figure by G. Porraz, N. Teyssandier & L. Wadley).



FIG. 5. Scrapers uncovered during the Wadley excavation of the Wilton occupation units at Rose Cottage Cave (figure by I. Guillemard).

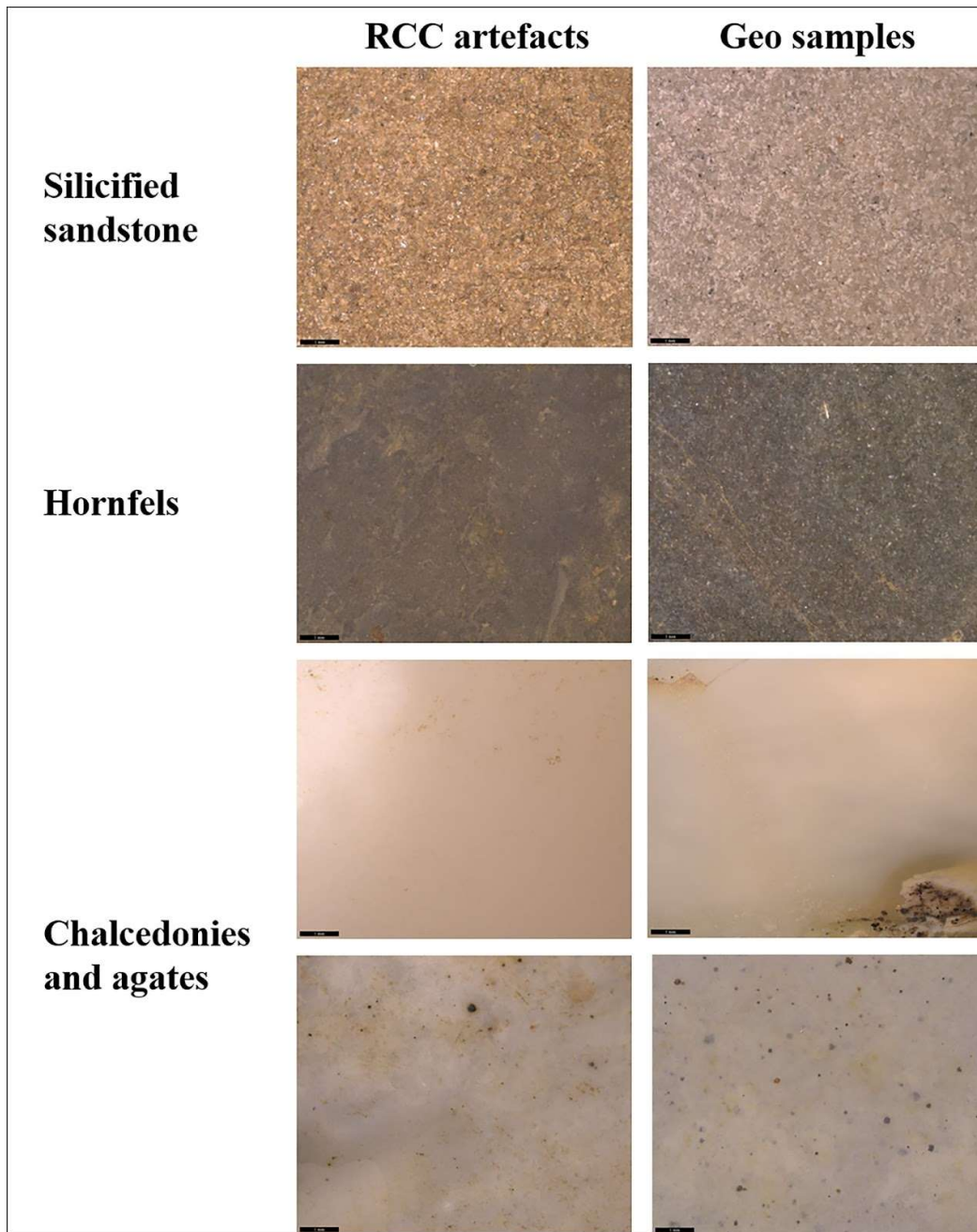


FIG. 6. Microphotos of artefacts from layer LEN (pre-Howiesons Poort at Rose Cottage Cave) of Harper collection and geological samples from the raw material survey around the site (figure by M. Brandl).

A)

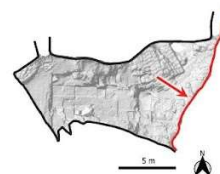


Rose Cottage Cave
Orthophoto of the eastern cave wall

0 1 2 3 4 5 m



Austrian
Archaeological
Institute
Prehistory & WWK Archaeology



B)



Rose Cottage Cave
Orthophoto of the southern cave wall

0 1 2 3



Austrian
Archaeological
Institute
Prehistory & WWK Archaeology

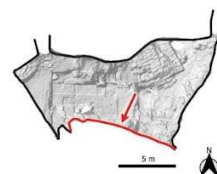


FIG. 7. A) Orthophoto of the eastern cave wall of Rose Cottage Cave with cave paintings with letters referring to Malan's excavation grid (figure by M. Börner); B) Orthophoto of the southern cave wall of Rose Cottage Cave with cave paintings and square designation from the Wadley excavation (figure by M. Börner).

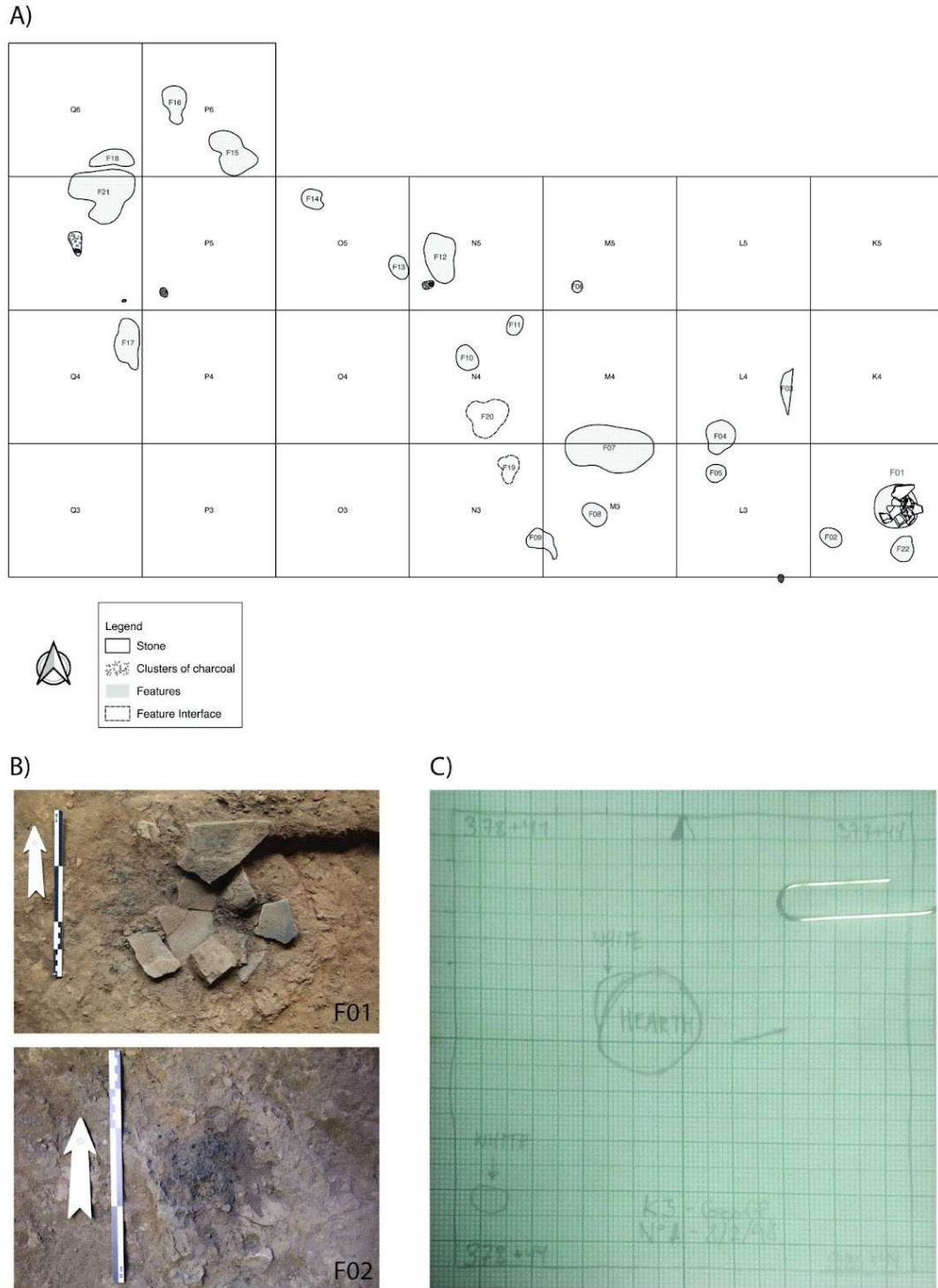


FIG. 8. Rose Cottage Cave: A) Plan of exposed excavation floor (final MSA layers Ge and Sv) from Wadley excavation at Rose Cottage Cave, showing all 22 features (figure by S. Pail); B) Close-up of Feature 01 (top) and Feature 02 (bottom) (photos by S. Pail); C) Drawing of last excavation episode during Wadley excavation 1998 in square K3.

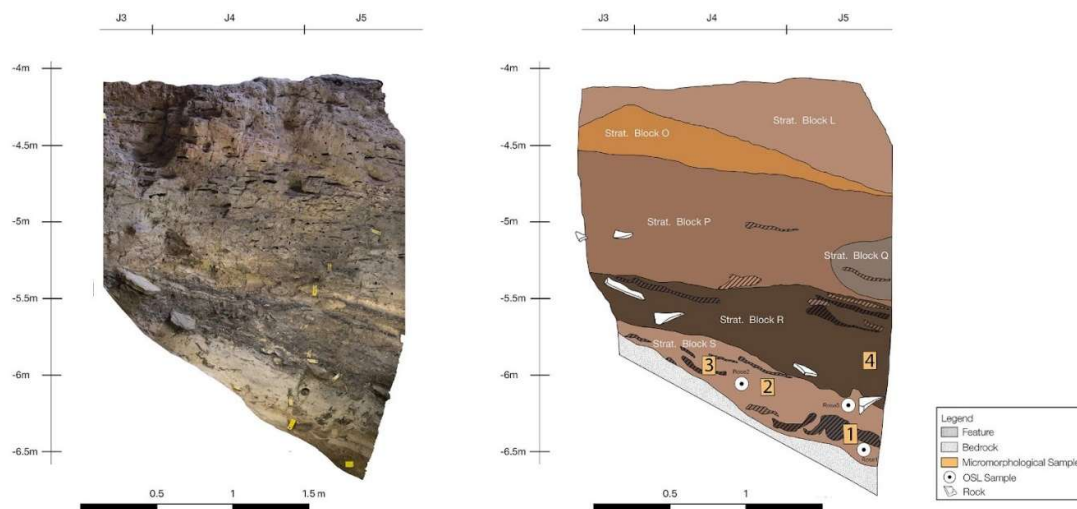


FIG. 9. Rose Cottage Cave: West Section of the Harper trench showing the orthophoto of the stratigraphic sequence on the left and drawing with the location of samples for micromorphology and OSL dating on the right (figure by S. Pail).

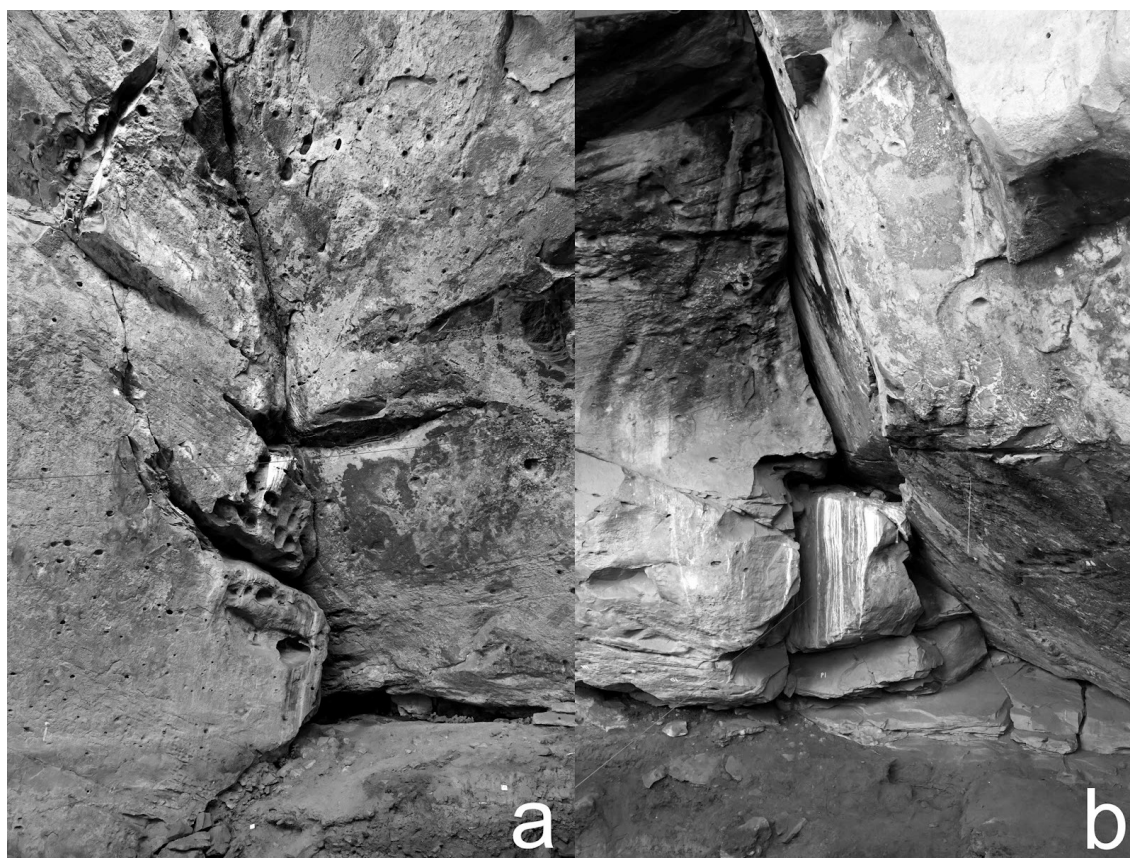


FIG. 10. Cracks between a) the eastern and southern walls and b) the southern and western walls (b) at Rose Cottage Cave (photos by D.M. Witelson).

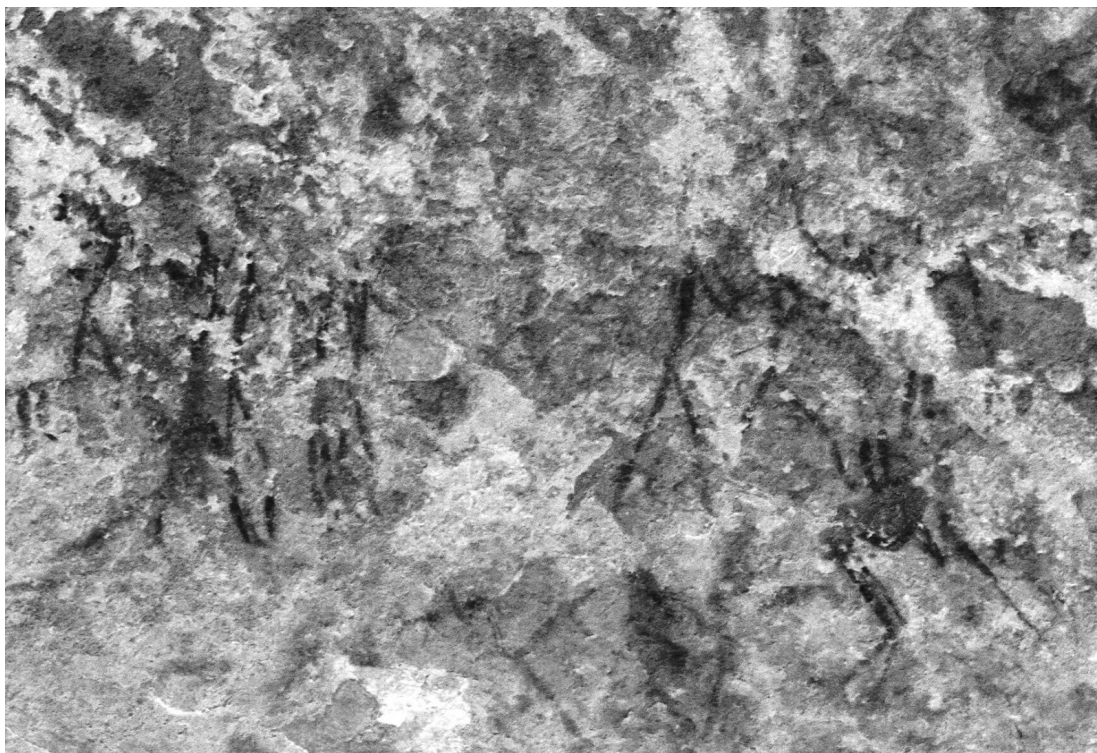


FIG. 11. Digital enhancements reveal additional human figures at Rose Cottage Cave that were previously difficult to document. Those shown here appear to depict a trance dance. Note the dancing figure with bent knees at bottom right (photo by D.M. Witelson).

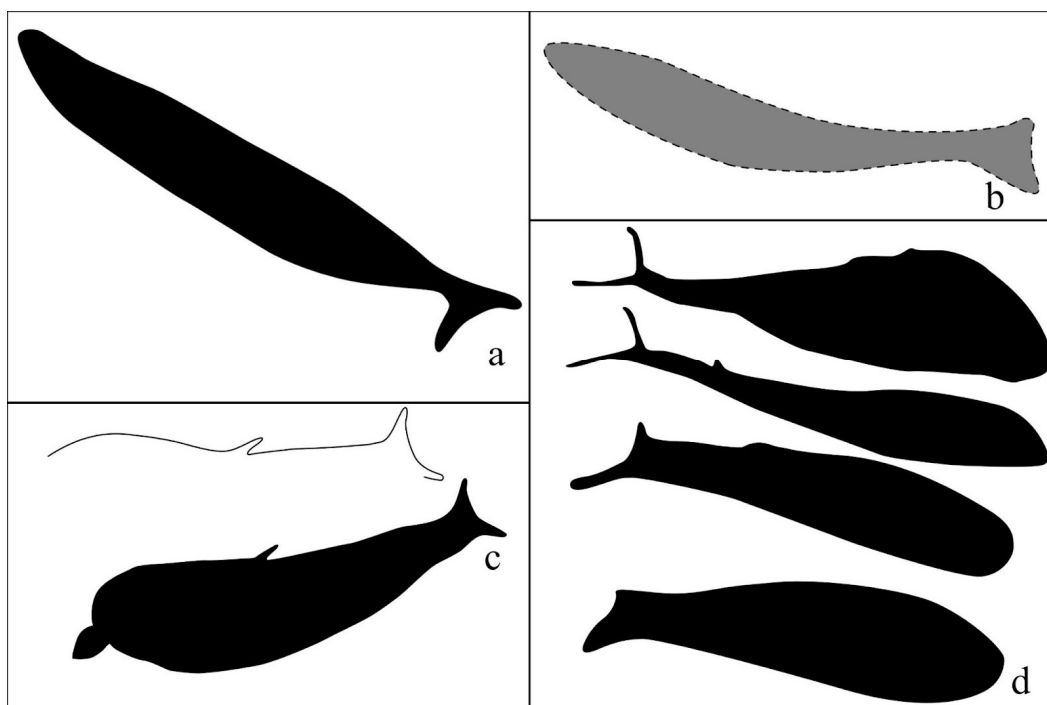


FIG. 12. Drawings from photographs of the eight red ichthyoid/cetacean motifs at Rose Cottage Cave (figure by D. M. Witelson).

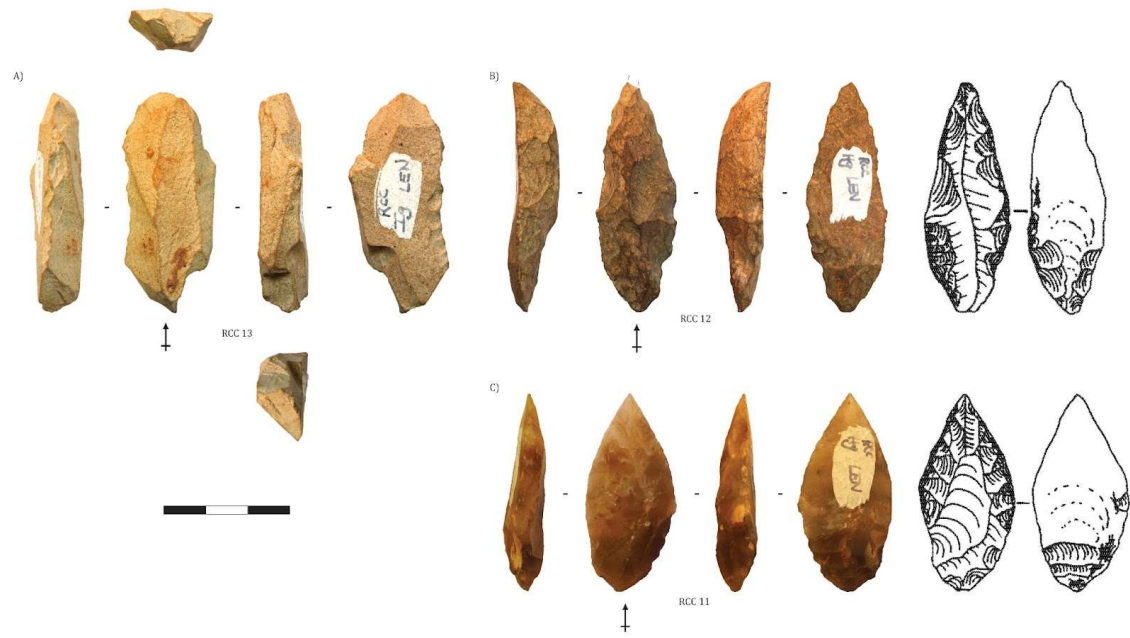


FIG. 13. A) Burin core; B) and C) Unifacial points with basal ventral thinning from the pre-Howiesons Poort of Rose Cottage Cave (figures by V.C. Schmid) with drawings by Harper (1997) (right).