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STRATHALAN CAVE REVISITED: STONE AGE NETWORKS AND ENVIRONMENTS AT THE FOOT OF THE DRAKENSBERG, SOUTH AFRICA

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ABSTRACT
The broader Drakensberg is an important region for understanding population dynamics and adaptation between the Late Pleistocene and Holocene. Here, we announce our campaign to re-excavate Strathalan Cave in the northeastern Cape of South Africa. Strathalan Cave sits at the foothills of the uKhahlamba-Drakensberg at the edge of the Great Escarpment of southern Africa. Well-known for its organic preservation, the site is important for understanding the archaeology of the region. People have occupied Strathalan Cave intermittently from ca. 29 000 years ago (ka), so exploring occupational patterns at sites such as these is a valuable means of understanding Stone Age behaviour during glacial Marine Isotope Stage 2 (ca. 29-14 ka). In this paper, we provide the first detailed description of the geological, geomorphological, sedimentary and environmental context of Strathalan Cave and review previous studies conducted on the site and region. We also introduce the goals of our re-excavation project and present a detailed map of the three cavities that make up the Strathalan Cave complex as part of a new, comprehensive, spatial control system established on site. Given the remarkable preservation of organic materials, Strathalan Cave may provide an important and rare source of archaeological and palaeoenvironmental data for this period. Future work at Strathalan will likely contribute to our understanding of the links between settlement patterns and environmental change. This is especially important given that Strathalan sits at the juncture between different environmental and geographic regions.

Keywords: Middle and Later Stone Age, Last Glacial Maximum, Marine Isotope Stage 2, Eastern Cape, site survey

1. Introduction

Southern Africa may have been a pivotal region in the development of complex behaviour and innovative technologies during the Late Pleistocene (Marean et al. 2007; Marean 2010; Henshilwood 2012; Wadley 2021; Wilkins et al. 2021). The spread of these techno-traditions through the subcontinent has significant implications for understanding the distribution of technology and populations in the Stone Age (Way et al. 2022). The broader Drakensberg region in southern Africa has an archaeological record extending back to Marine Isotope Stage (MIS) 5 (Carter 1978; Stewart & Mitchell 2018; Loftus et al. 2019). This record includes mountain rock shelters, open-air sites and a rich collection of rock art (Derricourt 1977; Carter et al. 1988). Encompassing the southern African Grassland Biome, the region is a resource-rich landscape with a diverse range of plants and animals which likely made this an attractive area for Late Pleistocene people (Stewart & Mitchell 2018). Given its centrality to the subcontinent and proximity to both the interior escarpment and coastal regions, the Drakensberg and its foothills may have been strategically significant and could hold important clues to understanding socio-ecological and technological dynamics from the cooler, glacial MIS 2 to the warmer Holocene.

Strathalan Cave borders the highlands of the uKhahlamba-Drakensberg and the grasslands of the northeastern Cape (Fig. 1). Its well-preserved organic material and extensive occupations from ca. 29 000 years ago (ka), make this a key site for understanding the archaeology of the region (Opperman

1996a). It has been proposed that Strathalan is located at the juncture of social networks that traversed the broader interior highlands and, possibly, the coastal regions (Fisher et al. 2020; Stewart et al. 2020). Strontium isotope analysis of ostrich eggshell (OES) beads from the Lesotho Highlands suggests the presence of extensive exchange networks across the region (Stewart et al. 2020). Marine shell beads recovered from interior sites such as Grassridge in the northeastern Cape and Sehonghong in Lesotho are good evidence of contact between the interior highlands and coastal regions (Mitchell 1996a; Collins et al. 2020). Population shifts in the interior and the coast may be linked to cooler conditions and environmental change associated with the Last Glacial Maximum (LGM; ca. 26-19 ka), the Younger Dryas (13-11.5 ka), and the Neoglacial (3.5-2 ka) (Clark et al. 2009; Stewart & Mitchell 2018; Thackeray et al. 2019). Moreover, human behavioural adaptations may also be linked to changing environmental conditions, although the extent of this relationship is complex (Pargeter & Faith 2020; Stewart & Challis 2023). Still, key questions arise as to how these periods of environmental stress influenced exchange networks and mobility, and Strathalan Cave may have a role to play in exploring this context. Exploring occupational patterns at sites like Strathalan is thus a valuable means of understanding Stone Age economy, settlement dynamics and ecology in the region.

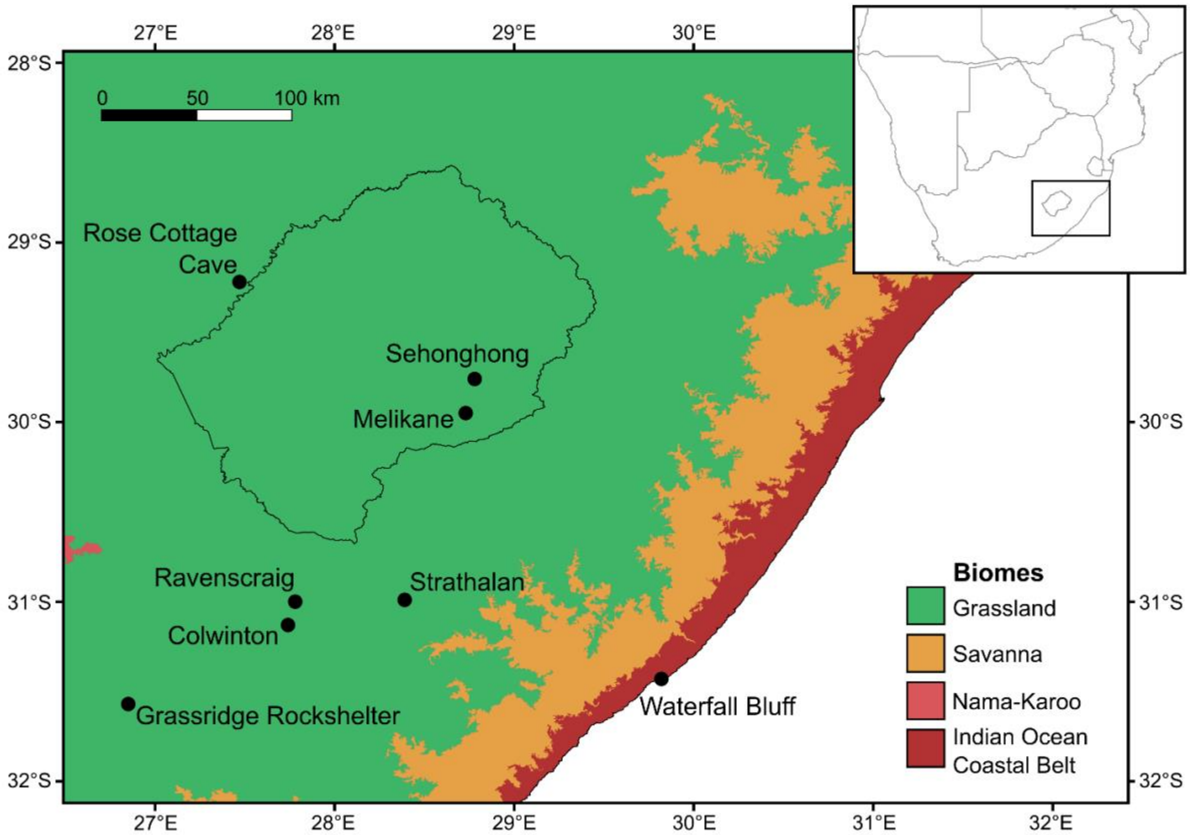

Figure 1. Regional map showing the sites mentioned in this study (vegetation based on Mucina & Rutherford 2011).

We are presently undertaking a new campaign of excavations at Strathalan Cave and a survey of the local region. The goal is to explore occupational patterns in the broader region and gain some insight into the local palaeoecology, augmenting and refining previous research by Opperman (1992, 1996a, b, 1999). The re-excavation of archaeological sites can benefit our understanding of past behaviour in numerous ways. Current advances in specialist *in situ* documentation and laboratory analyses were often not available to earlier excavators. Modern, conventional multi-disciplinary approaches include high-resolution spatial documentation of stratigraphy and artefacts with total stations, *in situ* geoarchaeological documentation and laboratory-based palynological, sedimentological and taphonomic analyses. The aim of this paper is fourfold: (1) to describe Strathalan Cave, its environmental, lithological and sedimentary context, and to review previous studies that have been undertaken on the site and region to provide a contextual foundation for the new research; (2) to introduce the goals and research questions of the Strathalan Cave Excavation Project; (3) to present the recent detailed spatial survey of the site, and; (4) to unpack the broader significance of our hypotheses for future research endeavours and what the implications may be for the site and surrounding region.

2. Site and regional background

Strathalan Cave (30°59'22.81" S, 28°23'18.59" E) sits at the foothills of the uKhahlamba-Drakensberg at the edge of the Great Escarpment of southern Africa (Fig. 2). It is a complex of three moderately sized, deposit-bearing cavities receding into the wall of a large, 100 m-long concave overhang hosted within lithologically variable Molteno Formation sandstones, ca. 1340 metres above sea level. At maximum height, the roof of the overhang is 8-10 m above the floor. Three individual cavities (hereafter, called caves) are named Cave A, Cave B and Cave C (Fig. 3). Cave A is located centrally within the overhang and is, at its entrance, approximately 9.5 m wide and 1.7 m high. The elongated cavity extends 18 m back into the larger shelter wall. Later Stone Age (LSA) material from the cave was dated to between ca. 10 ka to 2.5 ka. The LSA-bearing sediments are unconformably overlain by ephemeral occupations topped by an exceptionally well-preserved living floor dated to ca. 300 years ago (Opperman 1996b, 1999). Cave B, approximately 12 m south of Cave A, extends back into the overhang wall at a higher elevation than Cave A and C. The entrance to Cave B is approximately 4 m above the floor of the overhang. At its entrance, Cave B is approximately 7 m wide and 2 m high. The cave is generally circular in shape, about 13 m deep, and contains evidence of Middle Stone Age (MSA) occupations dated from ca. 29 ka to the onset of the LGM, ca. 22 ka (Opperman 1992). Cave C is 7 m north of Cave A and roughly at the same elevation within the overhang. At its entrance, Cave C is 8 m wide and about 2 m high. The roughly semi-circular cave is about 8 m deep. Our recent survey detected evidence of occupation in Cave C, indicating that it is deposit-bearing, but it is as yet unexcavated.

Figure 2. Strathalan Cave (white dot) and its surroundings. Dashed line represents the Pot River. White bar=500 m (map credit: Google Earth).

3. Geomorphology, geology and hydrology

Geomorphology

The Strathalan Cave overhang area has formed at a knickpoint in a short steep valley in an area of well-bedded sandstones of the Molteno Formation. Local vertical variability in the lithology has resulted in the exposure of a thick, generally horizontal, erosion-resistant sandstone bed, which forms a distinct bench and cliff system across the valley. Headward erosion of this bed, in several areas of the valley, has formed knickpoints and associated overhangs at the same general elevation. The roof of the Strathalan overhang represents the underside of this sandstone bed (Fig. 4). A perennial waterfall, fed from a spring that rises about 100 m upstream, cascades over the centre of the overhang onto collapsed sandstone blocks. This stream is one of four tributaries of the Pot River that converge from knickpoints in the same valley system. At Strathalan, the landscape immediately outside the overhang dripline slopes steeply to the southwest and can be described as a vegetated scree slope with massive, detached sandstone boulders remaining close to the outcropping sandstone ledge (Fig. 4). It is unlikely deposits would form or be preserved outside the dripline in this context, although isolated artefacts may be found on the slope. A line of very large, stacked, collapsed sandstone blocks lies just inside the dripline and stretches almost the whole length of the overhang (Fig. 5). Collapsed blocks are only missing from the vicinity around the waterfall, where the ground slopes steeply away to the southwest along the stream course. The collapse zones divide the shelter complex into two areas – Cave C to the north, and Caves A and B in the centre and south of the overhang.

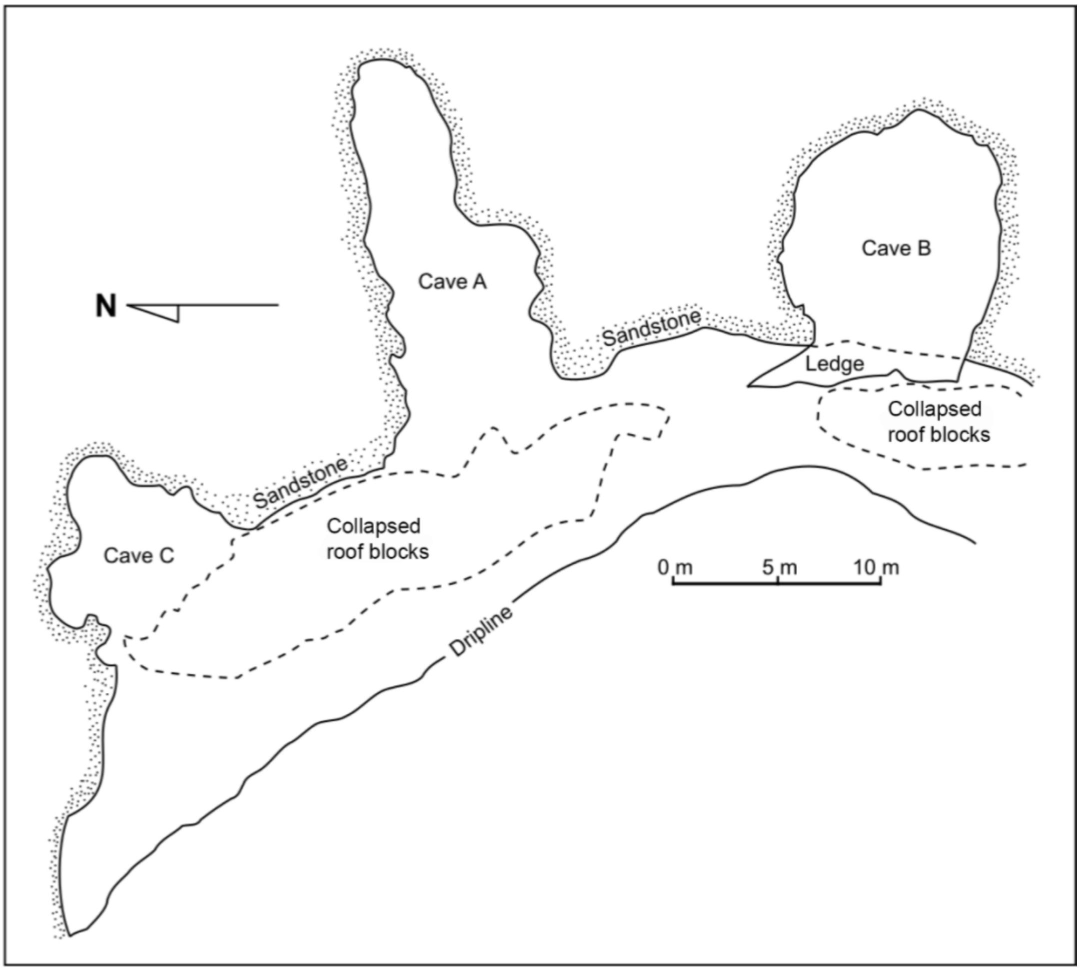

Figure 3. Strathalan Caves A, B and C within the overhang.

Differing geomorphological and geological characteristics across the overhang area, including elevations of sandstone beds and locations/depths of sandstone beds within the larger overhang, all contribute to site formation processes active at each cave. In addition, spatial proximity to fractures in the host rock and variability of the lithology of the host sandstones also play key roles in these processes. Consequently, each cave's sedimentary and archaeological assemblages will have formed under slightly different temporal and environmental conditions. For example, the roof of Cave A is a highly friable and loosely lithified coarse sandstone that breaks down rapidly. Potentially, the cavity formed quickly and was filled relatively quickly, limiting the maximum age of deposits here. To provide an initial perspective on the lithological influences on cavity and deposit formation, we present the first dedicated summary of the geological context of the caves.

Figure 4. Thicketed ravine in front of Strathalan Cave extending steeply downslope from the waterfall. Note the sandstone forming the roof of the overhang and the steep vegetated scree slope descending from the right.

Figure 5. Collapsed sandstone roof blocks inside the dripline of the Strathalan overhang. Cave A is behind the fence and to the right of the total station. Cave C is behind the collapsed roof blocks, to the right of the foliage.

Regional geology

The larger overhang and individual cave development has been guided by the lithology and bed thickness of the host rock. Strathalan is hosted within sandstones of the upper reaches of the Late Triassic Molteno Formation, Stormberg Group, of the Karoo Supergroup. The Molteno Formation has been divided and grouped into informal members by numerous authors (e.g., Turner 1975; Christie 1981; Macdonald 1993; Hancox 1998 – see Bordy et al. 2005 for summary) with only the Indwe Sandstone Member being formally defined and accepted by the South African Committee for Stratigraphy (SACS 1980). Above the Indwe Sandstone Member, up to ten units have been identified (e.g., Christie 1981) with noted lateral and vertical variability (e.g., Turner 1975; Bordy et al. 2005). Hancox (1998) has grouped the units of the upper Molteno into a 'transitional' member, while Bordy et al. (2005) placed them into the informal 'Tsqima' succession. To date, mapping and formal naming of upper Molteno units has not yet been completed. Following Christie (1981) and Bordy et al. (2005), the Molteno Formation sediments comprise a variably thick series of fluvially deposited sandstone units formed in broad, braided perennial rivers. Sediments in the upper Molteno units can generally be described as including massive and upwards fining packages composed of mostly immature matrix- and clast-supported sandstones with structures that include tabular, planar and planar cross-stratified forms. Sandstone sediment grain size is variable in its clay and silt content, and sand particles range from fine to very coarse. Occasionally, units are pebble-supported. Discontinuous massive and laminated planar mudstones and siltstones interstratify the sandstones. Frequent erosional surfaces are associated with well-defined wedge-shaped and tabular beds. At Strathalan, sandstones are often loosely lithified and crumble at a touch into single grains or granules.

Local geology

Locally, four major units (beds from hereout) are visible from the floor of the overhang to the dripline (Fig. 6). These units are tentatively attributed to the informal Tsqima succession based on unit geometry, sedimentology, and structure, but individual bed correlations are not yet possible. The four lithological units exposed at Strathalan are described below to provide context to the cavity formation processes and clastic sediments that contribute to the deposits.

The lower bed (Bed 1) is a horizontal tabular bed of siltstone composed of massive green silts and fine sands that are strongly lithified in fresh exposures and friable when weathered – exfoliating into small concave flakes. The upper contact of Bed 1 is gently undulating, and at the upper contact the unit may be laminated, or the laminations represent a thin interbedded mudrock draped over the undulating surface of Bed 1. Where Bed 1 has been preferentially weathered, receding from the vertical wall of the overhang, the underside of the base of Bed 2 is exposed. Here, negative casts of mud cracks can be seen in the base of Bed 2 suggesting the sands of Bed 2 formed into the mud-cracked surface of Bed 1 or the cracked surface of the interbedding mudrock.

Bed 2 is a 1-1.5 m thick succession of cross-bedded facies in wedge and tabular sub-units. Upwards-fining graded packages of quartz pebbles (sub-angular) line the bases of sequences over erosional truncations. Laterally, this is manifested as significant grain size variability. Bed 2 is friable and decays into detrital particles of coarse to very coarse immature sands. In the south of the overhang area (near Cave B), several additional sub-units are visible in Bed 2 and demonstrate local channel migration during deposition. One of these Bed 2 sub-units is particularly coarse and friable and constitutes the floor of Cave B. Cave B is elevated above the overhang floor and has formed in upper Bed 2 and Bed 3 sandstones.

Bed 3 is generally finer grained than Bed 2 and slightly more strongly lithified but retains the same general succession of cross-bedded, upwards-fining graded sub-units with wedge and tabular geometries. Bed 4 is the most resistant unit and forms the overhang dripline. It is finer grained than Beds 2 or 3, similarly structured at its base but becomes more massive in its upper reaches and is strongly lithified.

Each of the cavities in the Strathalan overhang has formed in and between different combinations of the identified beds exposed in the shelter. Consequently, the shape of each cave and the nature of the autogenically contributed geogenic sediments are different and have intriguing implications for the site formation processes acting across the larger site complex. Caves A and C formed predominantly in Bed

1, the friable siltstone, but differ in that Cave A's roof is defined by the contact between Bed 1 and 2 with the underside of the base of Bed 2 exposed across the roof. As expected, significant granulometric variability is present across the roof of the shelter. Cave C formed in the upper part of Bed 1 with the cavity roof extending upwards into Bed 2 and Bed 3. The autogenic geogenic contributions to the deposits in Caves A and C are defined largely by Bed 2 but also at the walls by decaying Bed 1. Cave C has a potential input from Bed 3. Cave B formed in Beds 2 and 3, with the floor being defined by the contact between Beds 2 and 3 and the roof ascending into the lower parts of Bed 4. Beds 2, 3 and 4 may contribute to the autogenic geogenic sedimentary component of Cave B.

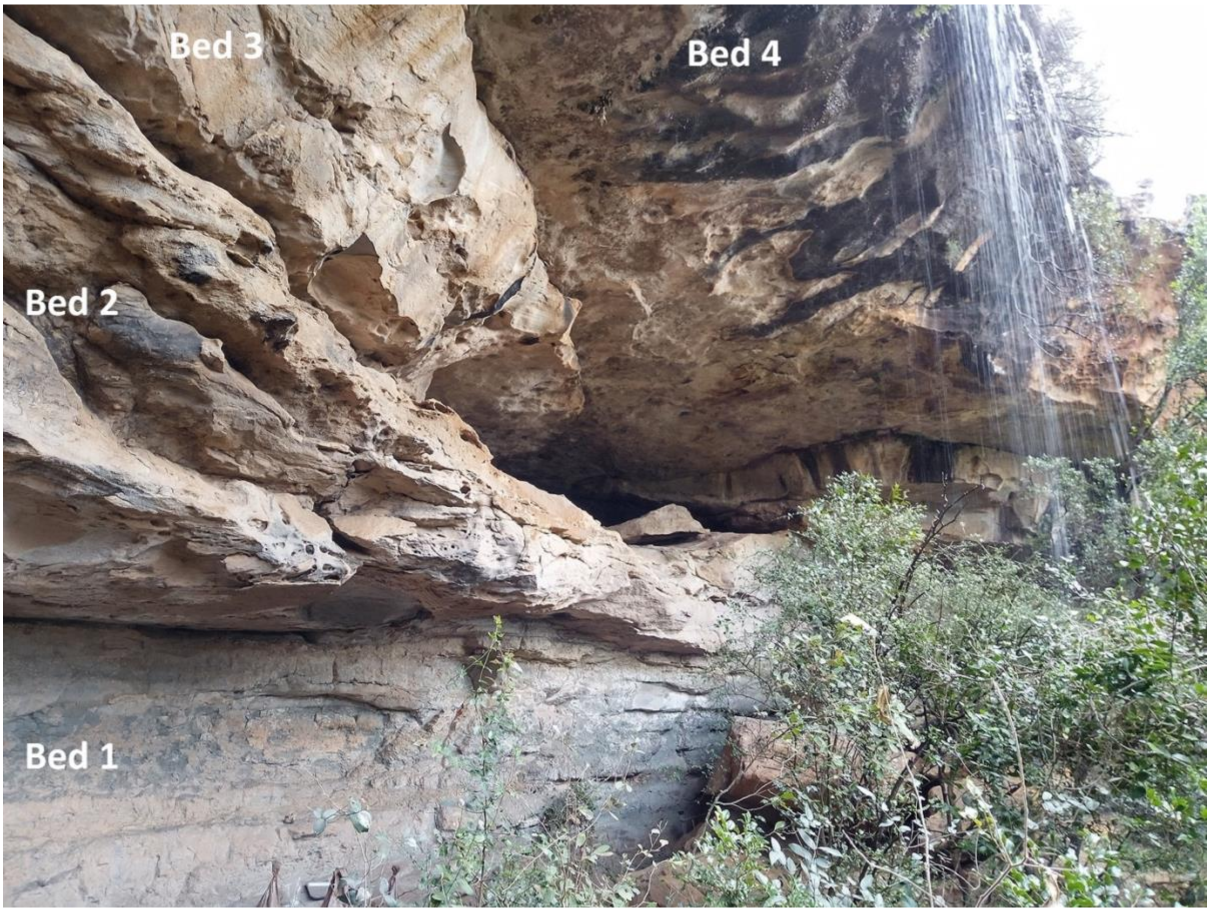

Figure 6. Cave B above the overhang. Note the waterfall descending from the dripline of the overhang. The elevated Cave B can be seen in the centre of the image. Cave A is immediately to the left of the position of the camera. All four local geological beds are labelled in the image. Bed 1 is at the base, Bed 2 and 3 are shown in the upper left corner, and Bed 4 rises to the dripline and waterfall.

Hydrology

Despite the potentially perennial flow of the waterfall (Fig. 6), evidence of water seepage, or penetration through the back of the shelter and into cavities, is limited to some localised flowstone formation on the eastern wall of Cave C and nodules of what is likely to be calcium carbonate on the wall of Cave B. No channels are evident. Some moisture is evident in the sediments in Caves A and C, but these caves are both closer to the overhang dripline and have larger entrances, which are more accessible to animals (entrances are at floor level). It is likely that the front of these caves receive moisture from heavy rains, fog and mist and spray from the dripline when very wet conditions prevail. A thick line of vegetation under the dripline also probably contributes to the conditions and attractiveness to animals of the overhang and Caves A and C. Some seepage is evident along the southern wall of the overhang from rainwater running down the north-facing slope of the valley. To the north, Cave C has a secondary dripline right below the overhang dripline making the cavity more prone to meteoric infiltration, and water can be seen seeping through a 3 m-long north-south running fracture in Bed 1.

4. Regional environment

Strathalan Cave sits in a significant biodiversity hotspot and is part of the Drakensberg Alpine Centre of Plant Endemism (UNESCO 2023). It occurs in the summer rainfall zone with most rain falling between October and March (Mucina & Rutherford 2011). Mean annual precipitation is around 780 mm; generally, in the form of thundershowers but mists are also an important supplier of moisture. Vegetation is dominated by grasses – many of those C4 grasses such as *Themenda triandra* – but with a strong shrub component (e.g., *Buddleja salviifolia*). Small trees (e.g., *Diospyros whyteana*) also occur in thickets in ravines (Mucina & Rutherford 2011). Opperman and Heydenrych (1990) note that dense patches of Protea and Watsonia occurred within two hours walk from the site.

Strathalan is part of the Eastern Lowlands floristic region of the Grassland Biome comprising the *Hyparrhenia hirta* tall grassland (Cowling et al. 2003). The site is at the interface of the Drakensberg and Sub-Escarpment Grassland Bioregions at the ecotone between East Griqualand Grassland and Southern Drakensberg Highland Grassland (Mucina & Rutherford 2011). Most of these grasses fall under Highveld Sourveld and Dohne Sourveld. Southern Drakensberg Highland Grassland occurs in the ridges and valleys of the Stormberg Mountains, dominating the eastern slopes of the uKhahlamba-Drakensberg region. The steep valley below the Strathalan Cave complex is typical of these landscapes with dense tussock grassland on the slopes and dwarf shrubland on exposed rocky outcrops. Grasslands are dominated by *Festuca* sp. with *Erica* sp. the most prevalent types of low shrubs. To the east of the Stormberg-Drakensberg range, Eastern Griqualand Grasslands dominate the terrain. These occur on the hilly slopes near Nqanqarhu and on the landscapes near Strathlalan. Vegetation in this region is dominated by grasses such as *Alloteropsis semialata* but also includes small thicket including *Diospyros lyciodes* and *Vachellia karroo*. Notable endemic plants in this bioregion include cycads (*Encephalartos friderici-guilielmi*) (Hoare & Bredenkamp 2001).

Historically, a diverse range of fauna including suids, antelope, baboons and carnivores occurred in the Nqanqarhu region (Skinner & Chimimba 2005). As expected, grazers are prevalent. Large game associated with open plains – zebra/quagga, blesbok/bontebok, and springbok – occurred in the region and were regularly hunted in the nineteenth century. Interestingly the ‘Inxu’ River, near Nqanqarhu, is likely to be a corruption of the isiXhosa word ‘iNqu’ meaning wildebeest (Skead 2007), suggesting that wildebeest were also common in the area. Eland, buffalo and oribi, a favourite target for colonial hunters, were noted in historical records of the region (Harris 1844 in Skead 2007). In the ravines and thicket, browsers such as bushbuck and duiker occurred, with rhebok and klipspringer occurring on mountain slopes and outcrops. Very large herbivores such as elephant and hippo were also recorded near Nqanqarhu. Given the diversity of herbivores, carnivores such as hyena and leopards were relatively common. While lions were rarely mentioned in historical records, place-names bearing the isiXhosa name for lion (inGonyama) suggests these predators were fairly common in the East Griqualand region (Skead 2007).

5. Previous research at Strathalan

The archaeology of the broader Drakensberg is relatively well-studied (Carter 1970, 1978; Mitchell 1994, 1996a, b; Stewart et al. 2016; Stewart & Mitchell 2018). In particular, the highlands of the Drakensberg have been a key area of interest since the nineteenth century (Orpen 1874; Jenkins 2019). Earlier research concentrated on the well-preserved rock art (Van Riet Lowe 1952; Willcox 1956; Vinnicombe 1960, 1976), while later studies generally focused on how people adapted to the harsh environmental conditions of the highlands (Carter 1976; Cable 1982; Mitchell 1990; Stewart et al. 2012; Mitchell & Arthur 2014; Loftus et al. 2015). The foothills of the Drakensberg are often seen as an intermediate region between the cold, harsh highlands of the Drakensberg and the grassland-dominated interior of southern Africa. Opperman (1982, 1987, 1988) excavated multiple sites in this region including Grassridge Rockshelter, Colwinton and Ravenscraig. He argued that hunter-gatherer groups generally focused on mountain resources and only exploited food resources in the foothills of the mountains in times of scarcity.

In a series of excavations, Opperman excavated Cave A and B in the 1980s and 90s (Opperman 1992, 1996a, b, 1999). In Cave B, excavations covering 12 m^2 removed a substantial amount of deposit reaching bedrock in less than 1 m. Radiocarbon dates from Cave B indicate occupations probably occurred during early MIS 2. We calibrated dates from Cave A and B in OxCal (Bronk Ramsey 2009, 2021) using the SH20 curve (Hogg et al. 2020) at two standard deviations. A sample of charcoal from the deepest layer (VBP) was dated to 27 600±420 BP (Pta-4642), providing calibrated ages of between 32 897 to 31 036 years BP. A series of six ages from layer BPL – the youngest anthropogenic layer – dated from 24 200±640 (Pta-4931) (29 850 to 27 313 years cal. BP) to 20 900±350 (Pta-4944) (25 860 to 24 260 years cal. BP) (Opperman & Heydenrych 1990). This puts the occupations at Cave B to just before the LGM (Clark et al. 2009) making it a valuable site to explore human responses to MIS 2. Besides the age of the site, Cave B is significant for several other reasons. Firstly, the spatial patterning indicates the site was used as a sleeping and living area. A relatively large hearth area occurs in the centre of the site, with bedding patches laid out in a semi-circular position around the hearths. Opperman and Heydenrych (1990: 95) argue that these deposits may reflect a series of single occupational events, and that "the patterning at least is consistent with a concordant series of penecontemporaneous and comparable events". The MSA deposits in Cave B are also significant in that they are associated with an MSA technocomplex that persisted to ca. 21 ka. Much of the lithic assemblage consists of whole irregular flakes (n=658; 45%) with 'flake-blades' (blades; n=175; 12%) also common. Hornfels is by far the most common material (~85%) but chalcedony (~12%) also occurs.

Another significant aspect of Cave B is its well-preserved grass bedding and plant remains (Opperman & Heydenrych 1990). The species used in the bedding could not be identified because leaf blades, used for identification, had not survived. Carbon-13 values were more negative than -22‰ indicating that these were C3 grasses. Other preserved botanical remains include twigs, corm scales, seeds and charcoal. Sagewood (*Buddleja salviifolia*) and geophytes such as Watsonia, *Tritonia-Freezia*, and aloe species were identified. Two specimens of unidentified plant stems were recovered tied in knots. Approximately 3 kg of faunal remains were recovered from Opperman's excavations, with most of these from the hearth area (Opperman 1996a). The identified sample reflects what is expected from the historical record including the ubiquitous hyrax and eland, grazers (wildebeest and bontebok/blesbok) and plains game (springbok). Interestingly, a Hippotragine specimen was also recovered. It is possible that this represents roan (*Hippotragus equinus*), a gregarious bovid associated with open habitats near dependable water sources.

Excavations were also undertaken in Cave A, the main rock shelter (Opperman 1996b, 1999). Initially, a 2x1 m test pit was excavated followed by a 5x1 m trench with deposits reaching a depth of 1.2 m. Material from the lowest layers was dated to 9400±900 BP (Pta-4634) (13 183 to 8590 years cal. BP), placing initial occupations here to the onset of the Holocene. A date of 2470±45 BP (Pta-4678) (2706 to 2351 years cal. BP) from the upper layer indicates the cave was regularly occupied for millennia (Opperman 1996b). As in Cave B, hornfels and chalcedony were the most common raw material used for lithics. Scrapers dominated the formal tool assemblage and bone tools were also quite prevalent. The bone tools and artefacts discovered included bone points, pendants, an awl, a bead and a broken fishhook. Wooden artefacts including pegs, a digging stick and a curved piece of worked wood – possibly part of a bow – were also recovered; with most of these from Layer 2 (probably slightly older than ca. 2.5 ka). Other artefacts included cut reeds (likely used for arrows) and fragile items such as string, and a fragment of dressed skin (Opperman 1996b). Fauna and flora are well-preserved, though the site is dominated by plant remains. Protea and Watsonia remains were apparently relatively common. Grass bedding occurs throughout the cave relatively close to the surface. Numerous knotted plant stems similar to those discovered in Cave B were recovered. Most of these were identified as Watsonia with their stems tied in bunches. A small faunal sample was recovered with small bovids such as grey rhebok and klipspringer more common. Grazers such as *Hippotragus* and equid also occurred. Numerous specimens of land snail (*Achatina immaculata*) shells were also recovered, with most of these from Layer 2.

The excavated materials from Cave A and B paint a picture of shifting occupational patterns from the Late Pleistocene to the Holocene. Based on Opperman's excavations, occupations at Strathalan Cave began in Cave B during the MIS 3/2 transition. In that shelter, successive groups probably used the same areas repeatedly as sleeping, hearth and food processing places (Opperman 1996b). Artefact and faunal abundance decline from the earlier to later layers in Cave B, which suggests decreasing frequencies of occupations through MIS 2. At the onset of the LGM, occupations at Strathalan cease, with people only reoccupying the site almost 10 000 years later. Many of the recovered plant remains suggest that plants were exploited for a variety of reasons. The dominance of geophytes indicate that these were important sources of food, and sagewood was likely used for firewood but may have also been used for its medicinal properties (Van Wyk & Van Wyk 1997). The knotted plant stems were probably tied to make them easier to transport and resemble the tied stems recovered at LSA sites such as Melkhoutboom in the southeastern Cape (Deacon 1976).

Environmental changes are also evident in the Cave A and B deposits. The environment of this region was likely wetter and more ameliorable after the Pleistocene-Holocene transition (Lewis 2008; Fitchett et al. 2016; Stewart & Mitchell 2018). This may also have been the case before the onset of MIS 2 and the LGM. Extralimital animal species at Strathalan may indicate increased moisture. *Hippotragus* occurs in both Cave A and B and is reported from rock paintings in the eastern Drakensberg (Carter 1978). Roan occurred in the mid-Holocene deposits of Rose Cottage Cave and Colwinton (Plug 1997), so it is feasible that the *Hippotragus* remains at Strathalan Cave are that species. The possible presence of roan in Layer VBP in Cave B and in Cave A suggests a productive environment with higher quality grass than at present (Arthur et al. 2018). The differences in faunal profiles between Cave A and B may suggest not just environmental change but shifts in subsistence strategies. For example, the prevalence of small fauna such as hyrax and small bovids in Cave A (compared to the larger bovids in Cave B) may also reflect the use of snares and traps. Regarding vegetation, C4 grasses such as *Themenda triandra* currently predominate the non-agricultural environs around Strathalan (Mucina & Rutherford 2011). The apparent prevalence of C3 grasses found in the bedding of Cave B points to a decline in temperature at Strathalan since C3 grasses thrive in cooler conditions. Pollen and isotopic data suggest that the environment around Strathalan Cave corresponded to interstadial conditions with more open grasslands from ca. 34 to 24 000 BP. Thereafter, vegetation resembled the alpine belt of the Drakensberg (Opperman & Heydenrych 1990; Lewis 2008).

6. Current projects and regional studies

Data from newly (re)excavated sites are an important means of documenting occupational movements within the interior, particularly between the interior plains and higher altitude regions. Currently, numerous studies are focusing on the interior of southern Africa, recognising that this area is just as significant to understanding the development of modern human behavioural complexity as coastal regions (e.g., Backwell et al. 2018; de la Peña et al. 2019; Wilkins et al. 2021). Various groups of researchers have established several transdisciplinary projects to explore, in more detail, occupational patterns and mobility in the greater Eastern Cape highlands and Drakensberg interior (e.g., Stewart et al. 2012; Fisher et al. 2013; Collins et al. 2017; de la Peña & Witelson 2020).

Earlier studies of the Eastern Cape and Drakensberg region tended to focus on seasonality and mobility between the coast and the interior (Carter 1970, 1976; Deacon 1976; Cable 1982; Mitchell 1996a). Stewart et al. (2016), however, argue that the Senqu/Orange River Valley was a key route for social networks and seasonal mobility, and OES bead distribution patterns seem to support this. Analyses of strontium isotope ratios of OES beads from sites in the Drakensberg and Lesotho highlands indicate that these beads probably originated from geological formations occurring in the more water-stressed subcontinental interior (Stewart et al. 2020). In combination with ostrich regional distributions, this suggests that Lesotho highland group exchange networks extended hundreds of kilometres throughout the region and may have included Strathalan Cave (Stewart et al. 2020). Occupational patterns across various sites in this region may also point to possible links between these sites. Sedimentary hiatuses are reported at Sehonghong (Lesotho) and Rose Cottage Cave (Free State) between ca. 29 and 25 ka (Pargeter et al. 2017; Loftus et al. 2019) which have been interpreted by the authors as occupational hiatuses. While it must be noted that sedimentary hiatuses and/or unconformities should not necessarily be interpreted as human occupational intervals (Stratford et al. 2021), the fact that these appear to correspond to occupational periods in Cave B (Opperman 1996a) may point to settlement links between Strathalan and these sites. This will be explored in more detail in our new investigations.

Strathalan Cave may also inform on the broader archaeological context of the region. The lithic assemblage from Cave B, dated to between ca. 29-22 ka, is categorised as a final MSA industry and is one of the most recent occurrences of MSA technology in southern Africa (Lombard et al. 2012, 2022). Sites relatively close to Strathalan with final MSA lithics include Melikane (ca. 38 ka cal. BP; Stewart et al. 2012), Sehonghong (ca. 30 ka; Mitchell 1994) and Grassridge rock shelter (ca. 32 ka; Ames et al. 2020) (Fig. 1). Sites in the broader Drakensberg region with final MSA assemblages that persist into MIS 2 – like Strathalan – are rare and include Ha Makotoko in Lesotho (ca. 28 ka; Mitchell & Arthur 2014) and Rose Cottage Cave (ca. 28 ka; Pienaar et al. 2008). Other sites in the eastern region of southern Africa such as Umbeli Belli (ca. 29 ka; Bader et al. 2018), Sibebe in eSwatini (ca. 37-27 ka cal. BP; Bader et al. 2022), and Holley Shelter in KwaZulu-Natal (36-34 ka cal. BP; Bader et al. 2024) also have relatively late MSA industries, with many persisting to MIS 2. The MSA lithics from Strathalan Cave also show apparent similarities to assemblages in this region. For example, the MSA 6 lithic assemblage at Sehonghong resembles Strathalan and Rose Cottage Cave (Bader et al. 2018), and, as at Strathalan, hornfels dominates the MSA 6 and 9 at Sehonghong and Umbeli Belli (Carter et al. 1988; Bader et al. 2018). The persistence of MSA technology in the broader Drakensberg and eastern region raises important questions as to the scope of connections and mobility patterns during later MIS 3/early MIS 2.

While Strathalan was likely part of wider social and exchange networks spanning the broader Drakensberg and Lesotho highlands region, it is also possible that it may have been part of coastal exchange networks. Fisher et al. (2020) argue that the coast was probably a significant part of these regional exchange networks. They note that the presence of vervet monkey and marine shell at Sehonghong, and OES beads at Waterfall Bluff suggests contact between the interior highlands and the Indian Ocean. The current impression of settlement patterns suggests that the Drakensberg highlands was a key centre of occupational intensity during the Late Pleistocene. Radiocarbon dates indicate that the highlands of Lesotho were occupied from ca. 83 ka at Melikane, and regularly from MIS 3 (Stewart & Mitchell 2018). Ephemeral occupations – and possible hiatuses – are noted during the peak of the LGM (ca. 23-19 ka) (Loftus et al. 2019). Along the coast, persistent occupations are recorded at Waterfall Bluff from MIS 3 to the early Holocene (Fisher et al. 2020). Indeed, Fisher and colleagues suggest that Waterfall Bluff may have acted as a refugium during the LGM, especially as deteriorating environmental conditions in the Drakensberg highlands would have driven populations out of the highlands. The question then is how Strathalan Cave would fit into these scenarios, and how could the re-excavation of the site better our understanding of the archaeology of the region.

7. Strathalan Cave research goals

A key goal of the Strathalan Caves Excavation Project is to augment the research of these various projects with data from our new excavations. Our key research questions are the following:

1. Can we link environmental conditions at Strathalan with occupational patterns?

Reorganisation of social, subsistence and mobility patterns may be linked to significant periods of environmental stress such as glacial/interglacial transitions (Brink & Henderson 2001; Pargeter & Faith 2020). A priority for the Cave B excavation is to undertake a new dating programme to confirm whether these deposits occurred during the LGM. It is important to note that LGM deposits are rare in southern Africa, so Strathalan could answer some key questions on environmental conditions during the LGM (for example, see discussion in Fisher et al. 2020 and Faith et al. 2024). Plant and organic remains are well-preserved at the site and may reveal a wealth of information on palaeoenvironmental conditions. Given time limitations, none of the twigs, leaves, seeds and charcoal from Cave B were identified, and neither was the species that make up the grass bedding. The first, and most obvious, question would be what grasses comprised the grass bedding. In our recent survey of the site, twigs, seeds and other plant remains were abundant in the deposit profiles, so it would be crucial to identify these. The Holocene deposits in Cave A could also be critical in exploring environmental change over the last 10 000 years. Previous studies suggest the reoccupation of the Eastern Cape Drakensberg only begins from ca. 10 ka (Stewart & Mitchell 2018; Loftus et al. 2019). This is supported by Opperman's excavation of Cave A where the lowest layer in the rear of the cave was dated to ca. 10 ka (although, it is possible that deposits in the front of Cave A and C date to earlier than that). Because Strathalan Cave may yield a virtually unbroken sequence from at least 10 to 2 ka, it would be interesting to explore how significant environmental changes such as the 8.2 ka event and Neoglacial affected this region. The period from ca. 6 ka to the Neoglacial is also not well-known, with little data available from the Maloti-Drakensberg region. It was likely to have been dryer and warmer (Lewis 2008; Stewart & Mitchell 2018) but more data are needed to explore this period. Palaeoenvironmental data from Cave A could expand our knowledge of this timeframe in the region.

2. Is there any archaeological evidence to link Strathalan Cave with the coast and/or the Lesotho highlands?

We hypothesise that there was contact with the coast. Major rivers such as the Mzimvubu and Mngazi on the eastern coast originate in the eastern Drakensberg. The Pot River – one of the sources of the Mzimvubu – literally runs through Strathalan Cave (Fig. 2), so it is feasible that groups could have moved along these river routes to the coast. One avenue of investigation would be to search for exchange artefacts between Strathalan Cave and coastal sites. Marine shell, bone tools, exotic coastal-linked faunal remains and other artefacts recovered from new excavations could disclose these connections. With regards to the Lesotho highlands, there is good evidence for contact between Strathalan and the broader Drakensberg region during the Pleistocene. Cursory observations of the lithic assemblage in Cave B suggests that they resemble those from Sehonghong and Rose Cottage Cave (Carter et al. 1988; Bader et al. 2018). Detailed technological and typological analyses of the lithics may reveal if these similarities imply a more comprehensive connection between these sites. Evidence for connections between the broader Drakensberg region and Strathalan during the Holocene may be more convincing. Strontium analyses and OES distribution networks suggest strong links between the Strathalan Cave surroundings and the Lesotho highlands (Stewart et al. 2020).

3. What can the faunal and archaeological material reveal about subsistence behaviour?

Zooarchaeological analyses are critical to examining subsistence patterns and could also reveal transport decisions inherent in long-distance exchange networks. Taphonomic analyses of faunal remains (which were not common in the 1990s) would highlight specific subsistence strategies used by the Strathalan occupants and may also be used to explore occupational intensity through the sequence (Reynard 2022). Detailed taphonomic analyses would also be crucial in examining the faunal remains to identify worked bone. Over the last few decades, valuable zooarchaeological studies have been undertaken at sites in the broader regional Drakensberg (Plug & Engela 1992; Plug 1997; Plug & Mitchell 2008; Pargeter & Dusseldorp 2022; Dewar et al. 2024). In combination with these, new data from Strathalan could contribute significantly to our understanding of prey exploitation patterns in the region.

4. What can geoarchaeological analyses at Strathalan Cave tell us about site formation processes and settlement patterns at the site?

The application of archaeological micromorphology may provide additional insight into occupational intensities and durations, and site management behaviours (e.g., Goldberg & Berna 2010; Karkanas et al. 2015; Wadley et al. 2020). Micromorphological analyses may illuminate if site formation processes are linked to environmental conditions and, if so, how populations adapted to changing conditions. To date, microscale studies of MSA anthropogenic deposits in southern Africa have been conducted on significantly older contexts (Goldberg et al. 2009; Miller et al. 2013; Larbey et al. 2019; Wadley et al. 2020; Haaland et al. 2021; Morrissey et al. 2023). The deposits in Cave B provide an important opportunity to reconstruct these behaviours in a terminal MSA context, with the potential to compare them to those recorded at older sites. Analysing these particularly well-preserved deposits could also provide a very useful analogue for the study of older, less-preserved deposits at other sites. Since bedding was first recovered from Cave B in the 1990s, the analysis of bedding has undergone significant advancements with the more recent recovery of bedding at MSA sites such as Sibhudu and Border Cave (Wadley et al. 2011, 2020; Miller & Sievers 2012). Indeed, if the grasses used in the bedding at Cave B can be identified to species, it may inform on not just environmental conditions but also about the domestic habits of the occupants. For example, sagewood, identified in Cave B, may suggest the use of plants for aromatic or medicinal purposes. Sagewood is a fragrant plant that has also historically been used to make herbal tea, as a remedy for coughs and colic, and as an eye lotion (Mutshinyalo 2001).

8. Site survey

The Strathalan complex was surveyed in September 2022 to establish spatial control for future excavations and allow high-resolution spatial documentation in any area of the shelter complex. The survey was conducted with a Trimble C5 total station. A local coordinate system was chosen for the initial control. The main datum is located on the floor within the overhang, between Caves A and B, and was given the coordinates X=100.000; Y=100.000; Z=100.000. Two additional datum points were created outside Cave C. Backsights were marked and plotted on various surfaces around the overhang and inside the three caves to allow the total station to be set up anywhere in the complex by resection (Fig. 7). Points were plotted along the contacts between the deposit and cavity walls to create floorplans for the overhang and each of the caves. Significant features were surveyed, including the overhang's dripline, zones of major collapse, large rocks within the caves, and flowstone and animal burrows in Cave C. Finally, wherever possible, surviving grid markers from the Opperman excavations in Caves A and B were plotted to allow the integration of the existing excavation grids into the new coordinate system and any excavation grid developed. A photogrammetric model of the floor of Cave B was created to enable integration of the old grid and the new coordinate system, and to enable assessment of the condition of the excavation area for monitoring and consistent documentation (Fig. 8). Photogrammetry was used to build a model of the Cave B floor, from low angle oblique photographs that would enable generation of the above perspective and photographic detail. The height of the Cave B roof prohibits the capturing of a single image that includes the whole cave floor.

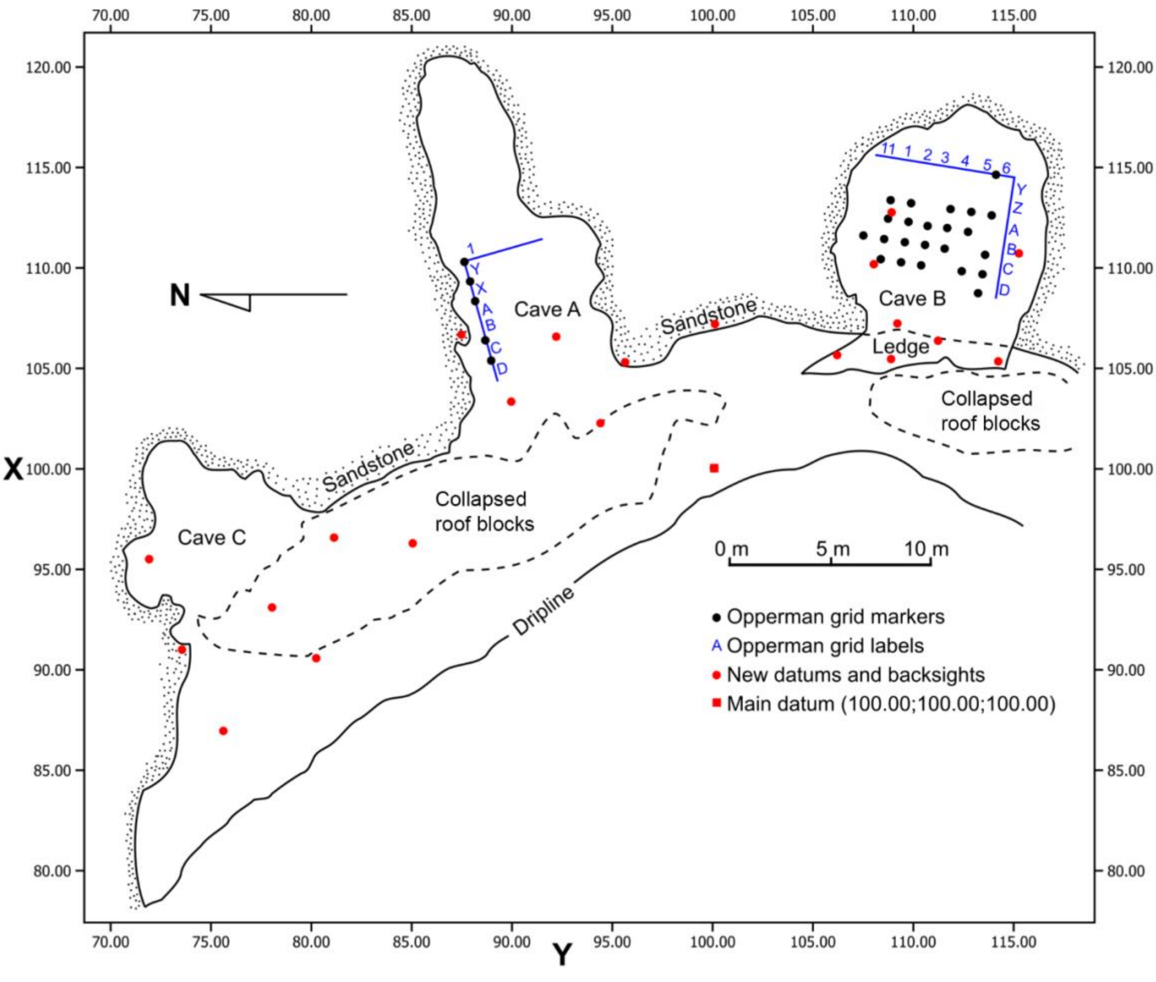

Figure 7. Grid markers and backsites in the Strathalan Caves.

9. Future research

Sitting at the juncture of diverse eco-regions and mid-way between high-altitude landscapes and rolling grasslands, Strathalan may have intersected with multiple social networks. Given this, future work at Strathalan will likely contribute to our understanding of the links between settlement patterns and environmental change. The excavations and surveying of the site and local area will be undertaken in a multi-phased approach. Phase 1 – the survey of the site – has been completed and is reported here. The second phase involves the excavation of Cave A and a survey of the local area. This phase is currently being undertaken, with results from the analyses of materials excavated from Cave A forthcoming. The next phase includes sampling and excavations in Cave B. Much of the bedding in Cave B is still well-preserved, so the focus here is on examining and analysing the bedding exposed from the Opperman cuttings. Finally, we plan to investigate and excavate the newly discovered Cave C. With the wealth of palaeoenvironmental data previously recovered from the site, it is our expectation that future excavations of Strathalan could yield significant information and play a key role in understanding human responses to environmental change in this transitional region.

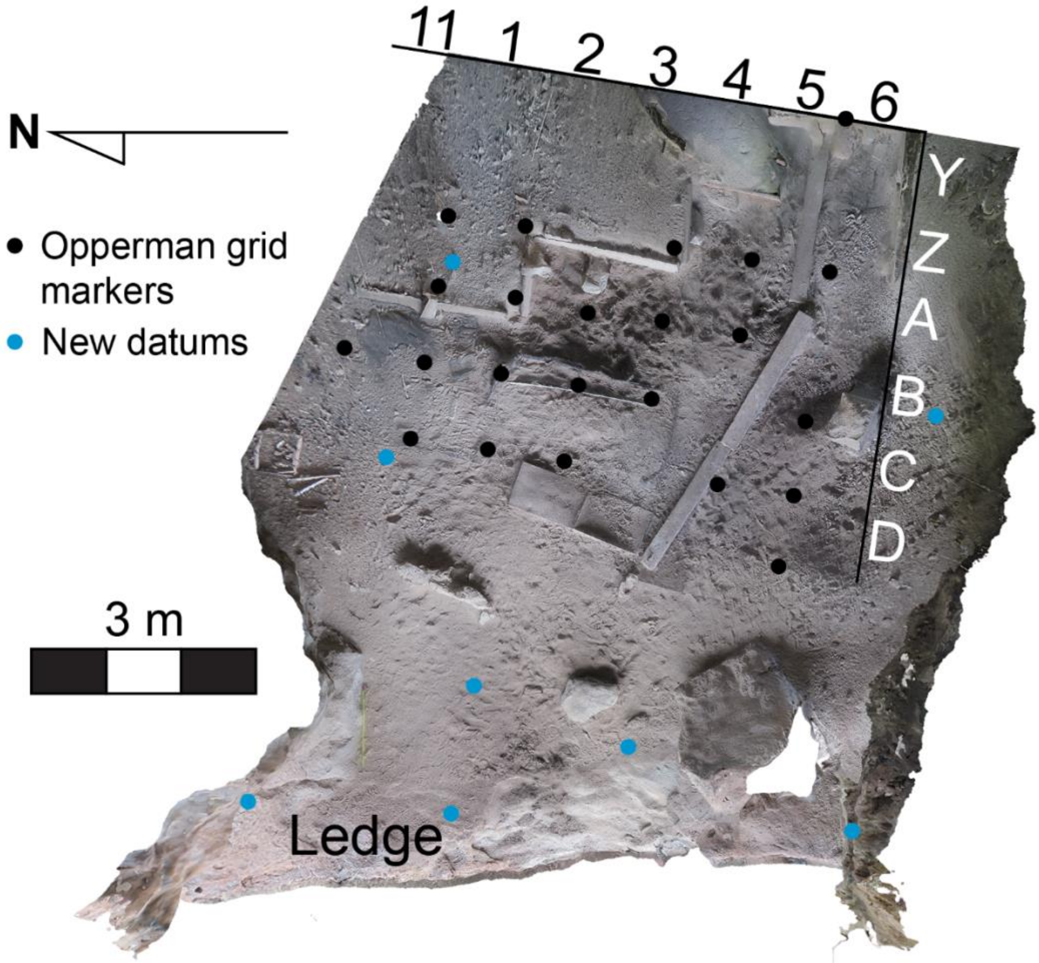

Figure 8. Photogrammetric model of the floor of Cave B.

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References

Ames, C.J.H., Gliganic, L., Cordova, C.E., et al. 2020. Chronostratigraphy, site formation, and palaeoenvironmental context of late Pleistocene and Holocene occupations at Grassridge rock shelter (Eastern Cape, South Africa). Open Quaternary, 6: 1-19.

Arthur, C., Mitchell, P., Dewar, G., et al. 2018. After the silt: Middle and late Holocene hunter-gatherer archaeology of the Metolong Dam, Lesotho. Southern African Humanities, 31: 129-179.

Backwell, L.R., d'Errico, F., Banks, W.E., et al. 2018. New excavations at Border Cave, KwaZulu-Natal, South Africa. Journal of Field Archaeology, 43(6): 417-436.

Bader, G.D., Mabuza, A., Williams, D.P., et al. 2022. Rethinking the Middle to Later Stone Age transition in southern Africa: A perspective from the highveld of Eswatini. Quaternary Science Reviews, 286: 107540.

Bader, G.D., Tribolo, C. & Conard, N.J. 2018. A return to Umbeli Belli: New insights of recent excavations and implications for the final MSA of eastern South Africa. Journal of Archaeological Science: Reports, 21: 733-757.

Bader, G.D., Val, A., Gevers, et al. 2024. Behind the waterfall – interdisciplinary results from Holley Shelter and their implications for understanding human behavioral patterns at the end of the Middle Stone Age in southern Africa. Quaternary Science Reviews, 331: 108633.

Bordy, E.M., Hancox, P.J. & Rubidge, B.S. 2005. The contact of the Molteno and Elliot formations through the main Karoo Basin, South Africa: A second-order sequence boundary. South African Journal of Geology, 108(3): 351-364.

Brink, J.S. & Henderson, Z.L. 2001. A high-resolution last interglacial MSA horizon at Florisbad in the context of other open-air occurrences in the central interior of southern Africa: An interim statement. In: Conard, N.J. (ed.) Middle Palaeolithic and Middle Stone Age Settlement Systems: 1-20. Tubingen: Kerns.

Bronk Ramsey, C. 2009. Bayesian analysis of radiocarbon dates. Radiocarbon, 51: 337-360

Bronk Ramsey, C. 2021. OxCal v4. 4.4. Available from: https://c14.arch.ox.ac.uk/oxcal.html (Accessed: 2024).

Cable, J.H.C. 1982. Aspects of Late Stone Age economic organization in southern Natal. Doctoral Thesis. Cambridge: University of Cambridge.

Carter, P.L. 1970. Late Stone Age exploitation patterns in southern Natal. The South African Archaeological Bulletin, 25(98): 55-58.

Carter, P.L. 1976. The effects of climate change on settlement in eastern Lesotho during the Middle and Later Stone Age. World Archaeology, 8: 197-206.

Carter, P.L. 1978. The prehistory of eastern Lesotho. Doctoral Thesis. Cambridge: University of Cambridge.

Carter, P.L., Mitchell, P.J. & Vinnicombe, P. 1988. Sehonghong: The Middle and Later Stone Age industrial sequence at a Lesotho rock-shelter. Oxford: British Archaeological Reports (BAR) International Series 406.

Christie, A.D.M. 1981. Stratigraphy and sedimentology of the Molteno Formation in the Elliot and Indwe Area, Cape Province. Masters Dissertation. Durban: University of Natal.

Clark, P.U., Dyke, A.S., Shakun, J.D., et al. 2009. The Last Glacial Maximum. Science 325(5941): 710-714.

Collins, B., Wilkins, J. & Ames, C. 2017. Revisiting the Holocene occupations at Grassridge Rockshelter, Eastern Cape, South Africa. The South African Archaeological Bulletin, 72(206): 162-170.

Collins, B., Wojcieszak, M., Nowell, A., et al. 2020. Beads and bead residues as windows to past behaviours and taphonomy: A case study from Grassridge Rockshelter, Eastern Cape, South Africa. Archaeological and Anthropological Sciences, 12(8): 192.

Cowling, R.M., Richardson, D.M. & Pierce, S.M. 2003. Vegetation of South Africa. Cambridge: Cambridge University Press.

de la Peña, P., Val, A., Stratford, D.J., et al. 2019. Revisiting Mwulu's Cave: New insights into the Middle Stone Age in the southern African savanna biome. Archaeological and Anthropological Sciences, 11: 3239-3266.

de la Peña, P. & Witelson, D.M. 2020. 'Project Piedemonte': Between the Maloti-Drakensberg and the Great Escarpment in the Eastern Cape Province, South Africa. Antiquity, 94(376): 1-9.

Deacon, H.J. 1976. Where Hunters Gathered: A Study of Holocene Stone Age People in the Eastern Cape. Cape Town: South African Archaeological Monograph Series 1.

Derricourt, R.M. 1977. Prehistoric Man in the Ciskei and Transkei. Cape Town: Struik.

Dewar, G., Zastrow, J., Arthur, C., et al. 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 Tšoana rock-shelters, Lesotho. Quaternary Science Advances, 13: 100170.

Faith, J.T., Chase, B.M. & Pargeter, J. 2024. The Last Glacial Maximum climate at Boomplaas Cave, South Africa. Quaternary Science Reviews, 329: 108557.

Fisher, E.C., Cawthra, H.C., Esteban, I., et al. 2020. Coastal occupation and foraging during the last glacial maximum and early Holocene at Waterfall Bluff, eastern Pondoland, South Africa. Quaternary Research,

97: 1-41.
Fisher, E.C., Poupart, M., Pargeter, J., et al. 2013. Archaeological reconnaissance for Middle Stone Age sites along the Pondoland Coast, South Africa. PaleoAnthropology, 2013: 104-137.
Fitchett, J.M., Grab, S.W., Bamford, M.K., et al. 2016. A multi-proxy analysis of late Quaternary palaeoenvironments, Sekhokong Range, eastern Lesotho. Journal of Quaternary Science, 31(7): 788-798.
Goldberg, P. & Berna, F. 2010. Micromorphology and context. Quaternary International, 214(1-2): 56-62.
Goldberg, P., Miller, C.E., Schiegl, S., et al. 2009. Bedding, hearths, and site maintenance in the Middle Stone Age of Sibudu Cave, KwaZulu-Natal, South Africa. Archaeological and Anthropological Sciences, 1: 95-122.
Haaland, M.M., Miller, C.E., Unhammer, O.F., et al. 2021. Geoarchaeological investigation of occupation deposits in Blombos Cave in South Africa indicate changes in site use and settlement dynamics in the southern Cape during MIS 5b-4. Quaternary Research, 100: 170-223.
Hancox, P.J. 1998. The Beaufort-Molteno contact revised: Ramifications for the development of the Karoo retro-foreland basin during the Triassic. Journal of African Earth Sciences, 27: 103-104.
Harris, W.C. 1844. The Wild Sports of Southern Africa: Being the Narrative of an Expedition from the Cape of Good Hope, Through the Territories of the Chief Moselekatse, to the Tropic of Capricorn. London: Pelham Richardson.
Henshilwood, C.S. 2012. Late Pleistocene techno-traditions in southern Africa: A review of the Still Bay and Howiesons Poort, c. 75–59 ka. Journal of World Prehistory, 25(3-4): 205-237.
Hoare, D.B. & Bredenkamp, G.J. 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg/Drakensberg mountain region of the Eastern Cape, South Africa. South African Journal of Botany, 67(4): 595-608.
Hogg, A.G., Heaton, T.J., Hua, Q., et al. 2020. SHCal20 Southern Hemisphere calibration, 0–55,000 years cal BP. Radiocarbon, 62(4): 759-778.
Jenkins, E. 2019. Rock art researchers in the uKhahlamba-Drakensberg. Natalia, 49: 50-64.
Karkanas, P., Brown, K.S., Fisher, E.C., et al. 2015. Interpreting human behavior from depositional rates and combustion features through the study of sedimentary microfacies at site Pinnacle Point 5-6, South Africa. Journal of Human Evolution, 85: 1-21.
Larbey, C., Mentzer, S.M., Ligouis, B., et al. 2019. Cooked starchy food in hearths ca. 120 kya and 65 kya (MIS 5e and MIS 4) from Klasies River Cave, South Africa. Journal of Human Evolution, 131: 210-227.
Lewis, C.A. 2008. Late Quaternary climatic changes, and associated human responses, during the last ~45 000 yr in the Eastern and adjoining Western Cape, South Africa. Earth-Science Reviews, 88(3-4): 167-187.
Loftus, E., Pargeter, J., Mackay, A., et al. 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.
Loftus, E., Stewart, B.A., Dewar, G., et al. 2015. Stable isotope evidence of MIS 3 to middle Holocene palaeoenvironments from Sehonghong, eastern Lesotho. Journal of Quaternary Science, 30(8): 805-816.
Lombard, M., Bradfield, J., Caruana, M.V., et al. 2022. The South African Stone Age sequence updated (II). The South African Archaeological Bulletin, 77: 172-212.
Lombard, M., Wadley, L., Deacon, J., et al. 2012. South African and Lesotho stone Age sequence updated (I). The South African Archaeological Bulletin, 67: 123-144.
Macdonald, A.J. 1993. A reassessment of coal resources in the western part of the Molteno coal province. Bulletin Geological Survey South Africa, 116: 1-33.
Marean, C.W. 2010. Pinnacle Point Cave 13B (Western Cape Province, South Africa) in context: The Cape floral kingdom, shellfish, and modern human origins. Journal of Human Evolution, 59(3-4): 425-443.
Marean, C.W., Bar-Matthews, M., Bernatchez, J., et al. 2007. Early human use of marine resources and pigment in South Africa during the Middle Pleistocene. Nature, 449(7164): 905-908.
Miller, C.E., Goldberg, P. & Berna, F. 2013. Geoarchaeological investigations at Diepkloof Rock Shelter, Western Cape, South Africa. Journal of Archaeological Science, 40: 3432-3452.
Miller, C.E. & Sievers, C. 2012. An experimental micromorphological investigation of bedding construction in the Middle Stone Age of Sibudu, South Africa. Journal of Archaeological Science, 39(10): 3039-3051.
Mitchell, P.J. 1990. A palaeoecological model for archaeological site distribution in southern Africa during the Upper Pleniglacial and Late Glacial. In: Gamble, C. & Soffer, O. (eds) The World at 18,000 BP: Low Latitudes: 189-205. London: Unwin Hyman.
Mitchell, P.J. 1994. The archaeology of the Phuthiatsana-ea-Thaba Bosiu basin, Lesotho, southern Africa: Changes in Later Stone Age regional demography. Antiquity, 68: 83-96.
Mitchell, P.J. 1996a. Prehistoric exchange and interaction in south-eastern southern Africa: Marine shells and ostrich eggshell. African Archaeological Review, 13: 35-76.
Mitchell, P.J. 1996b. Filling a gap: The early and middle Holocene assemblages from new excavations at Sehonghong Rock Shelter, Lesotho. Southern African Field Archaeology, 5: 17-27.

Mitchell, P. & Arthur, C. 2014. Ha Makotoko: Later stone age occupation across the Pleistocene/Holocene transition in western Lesotho. Journal of African Archaeology, 12(2): 205-232.

Morrissey, P., Mentzer, S.M. & Wurz, S. 2023. The stratigraphy and formation of Middle Stone Age deposits in Cave 1B, Klasies River Main site, South Africa, with implications for the context, age, and cultural association of the KRM 41815/SAM-AP 6222 human mandible. Journal of Human Evolution, 183: 103414.

Mucina, L. & Rutherford, M.C. (eds) 2011. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. Pretoria: South African National Biodiversity Institute.

Mutshinyalo, T.T. 2001. Buddleja salviifolia. Available at: https://pza.sanbi.org/buddleja-salviifolia (Accessed: 2024).

Opperman, H. 1982. Some research results of excavations in the Colwinton Rock Shelter, north-eastern Cape. The South African Archaeological Bulletin, 37: 51-56.

Opperman, H. 1987. The Later Stone Age of the Drakensberg Range and its Foothills. Oxford: British Archaeological Reports (BAR) International Series 339.

Opperman, H. 1988. An excavation of a Middle Stone Age deposit in Grassridge Rockshelter, Sterkstroom District, Cape Province. Fort Hare Papers, 9: 51-61.

Opperman, H. 1992. A report on the results of a test pit in Strathalan Cave B, Maclear District, north-eastern Cape. Southern African Field Archaeology, 1(2): 98-102.

Opperman, H. 1996a. Strathalan Cave B, north-eastern Cape Province, South Africa: Evidence for human behaviour 29,000-26,000 years ago. Quaternary International, 33: 45-53.

Opperman, H. 1996b. Excavation of a Later Stone Age deposit in Strathalan Cave A, Maclear District, northeastern Cape, South Africa. In: Pwiti, G. & Soper, R. (eds) Aspects of African Archaeology: 335-342. Harare: University of Zimbabwe Press.

Opperman, H. 1999. A 300-year-old living floor in Strathalan Cave A, Maclear District, Eastern Cape. Southern African Field Archaeology, 8: 76-80.

Opperman, H. & Heydenrych, B. 1990. A 22000-year-old Middle Stone Age camp site with plant food remains from the north-eastern Cape. The South African Archaeological Bulletin, 45: 93-99.

Orpen, J.M. 1874. A glimpse into the mythology of the Maluti Bushmen. Cape Monthly Magazine, 9(49): 1-13.

Pargeter, J. & Dusseldorp, G. 2022. The technology and ecology of Lesotho's highland hunter-gatherers: A case study at Sehonghong rock shelter. Quaternary International, 611: 134-145.

Pargeter, J. & Faith, J.T. 2020. Lithic miniaturization as adaptive strategy: A case study from Boomplaas Cave, South Africa. Archaeological and Anthropological Sciences, 12(9): 225.

Pargeter, J., Loftus, E. & Mitchell, P. 2017. New ages from Sehonghong rock shelter: Implications for the late Pleistocene occupation of highland Lesotho. Journal of Archaeological Science: Reports, 12: 307-315.

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. 1997. Late Pleistocene and Holocene hunter-gatherers in the eastern highlands of South Africa and Lesotho: A faunal interpretation. Journal of Archaeological Science, 24(8): 715-727.

Plug, I. & Engela, R. 1992. The macrofaunal remains from recent excavations at Rose Cottage Cave, Orange Free State. The South African Archaeological Bulletin, 47: 16-25.

Plug, I. & Mitchel, P. 2008. Sehonghong: Hunter-gatherer utilization of animal resources in the highlands of Lesotho. Annals of the Transvaal Museum, 45(1): 31-53.

Reynard, J.P. 2022. Tracking occupational intensity using archaeo-faunal data: Case studies from the late Pleistocene in the southern Cape of South Africa. Journal of Archaeological Method and Theory, 29(1): 214-250.

Skead, C.J. 2007. Historical Incidence of the Larger Land Mammals in the Broader Eastern Cape, Second Edition. Port Elizabeth: Centre for African Conservation Ecology, Nelson Mandela Metropolitan University.

Skinner, J.D. & Chimimba, C.T. 2005. The Mammals of the Southern African Sub-region. Cambridge: Cambridge University Press.

South African Committee for Stratigraphy (SACS). 1980. Stratigraphy of South Africa. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia, and the Republics of Bophuthatswana, Transkei and Venda (Compiler L.E. Kent). Geological Survey of South Africa Handbook, 8.

Stewart, B.A. & Challis, S. 2023. Becoming elands' people: Neoglacial subsistence and spiritual transformations in the Maloti-Drakensberg Mountains, southern Africa. Transactions of the Royal Society of South Africa, 78(1-2): 123-147.

Stewart, B.A., Dewar, G.I., Morley, M.W., et al. 2012. Afromontane foragers of the late Pleistocene: Site formation, chronology and occupational pulsing at Melikane Rockshelter, Lesotho. Quaternary International, 270: 40-60.

Stewart, B.A. & Mitchell, P.J. 2018. Late Quaternary palaeoclimates and human-environment dynamics of the Maloti-Drakensberg region, southern Africa. Quaternary Science Reviews, 196: 1-20.

Stewart, B.A., Parker, A.G., Dewar, G.I., et al. 2016. Follow the Senqu: Maloti-Drakensberg paleoenvironments and implications for early human dispersals into mountain systems. In: Jones, S.C. & Stewart, B.A. (eds) Africa from MIS 6-2: Population Dynamics and Palaeoenvironments: 247-271. Dordrecht: Springer.
Stewart, B.A., Zhao, Y., Mitchell, P.J., et al. 2020. Ostrich eggshell bead strontium isotopes reveal persistent macroscale social networking across late Quaternary southern Africa. Proceedings of the National Academy of Sciences, 117(12): 6453-6462.
Stratford, D., Braun, K. & Morrissey, P. 2021. Cave and rock shelter sediments of southern Africa: A review of the chronostratigraphic and palaeoenvironmental record from Marine Isotope Stage 6 to 1. South African Journal of Geology, 124(4): 879-914.
Thackeray J.F., Scott, L. & Pieterse, P. 2019. The Younger Dryas interval at Wonderkrater (South Africa) in the context of a platinum anomaly. Palaeontologia Africana, 54: 30-35.
Turner, B.R. 1975. The stratigraphy and sedimentary history of the Molteno Formation in the main Karoo Basin of South Africa and Lesotho. Doctoral Thesis. Johannesburg: University of the Witwatersrand.
UNESCO World Heritage Convention 2023. Maloti-Drakensberg Park. Available from: https://whc.unesco.org/en/list/985/ (Accessed: 2023).
Van Riet Lowe, C. 1952. The Distribution of Prehistoric Rock Engravings and Paintings in South Africa. Pretoria: Union of South Africa, Department of Education, Arts, and Science, Archaeological Survey.
Van Wyk, B. & Van Wyk, P. 1997. Field Guide to the Trees of Southern Africa. Struik: Cape Town.
Vinnicombe, P.J. 1960. The recording of rock paintings in the upper reaches of the Umkomaas, Umzimkulu and Umzimvubu rivers. South African Journal of Science, 56(1): 11-14.
Vinnicombe, P. 1976. People of the Eland: Rock Paintings of the Drakensberg Bushmen as a Reflection of their Life and Thought. Pietermaritzburg: University of Natal Press.
Wadley, L. 2021. What stimulated rapid, cumulative innovation after 100,000 years ago? Journal of Archaeological Method and Theory, 28(1): 120-141.
Wadley, L., Esteban, I., De La Peña, P., et al. 2020. Fire and grass-bedding construction 200 thousand years ago at Border Cave, South Africa. Science, 369(6505): 863-866.
Wadley, L., Sievers, C., Bamford, M., et al. 2011. Middle Stone Age bedding construction and settlement patterns at Sibudu, South Africa. Science, 334(6061): 1388-1391.
Way, A.M., de la Peña, P., de la Peña, E., et al. 2022. Howiesons Poort backed artifacts provide evidence for social connectivity across southern Africa during the Final Pleistocene. Scientific Reports, 12(1): 9227.
Wilkins, J., Schoville, B.J., Pickering, R., et al. 2021. Innovative Homo sapiens behaviours 105,000 years ago in a wetter Kalahari. Nature, 592(7853): 248-252.
Willcox, A.R. 1956. Rock Paintings of the Drakensberg. London: Max Parrish.