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New Research at Mirabib Rockshelter

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Abstract

Mirabib Rockshelter, located near the Kuiseb River in the Namib-Naukluft National Park, is one of the best known archaeological sites in the Namib Desert. Previous excavations in the 1970s revealed a complex history of occupation stretching from the early Holocene until the proto-historical period. New research at Mirabib has pushed its chronology back to ca. 18–21 ka BP and revealed new insights into human adaptations in the region. While the site has yielded exceptionally well-preserved evidence going back to the terminal Pleistocene, there is still a great deal of untapped potential for learning more about human life in the Namib in the distant past.

Introduction

Mirabib Rockshelter is a large archaeological site located in the gravel plains of the central Namib Desert in western Namibia. Excavations over the past fifty years at Mirabib have revealed extensive and well-preserved Late Stone Age deposits as well as tentative Middle Stone Age artifacts from the lowermost levels. The site's unique environmental setting, diverse history of occupation, intact strata, and well-preserved organic remains makes it easily one of the most important archaeological sites currently known from this part of Namibia.

Mirabib sits within an expansive granite and schist *inselberg* complex approximately thirty miles east of the Gobabeb Namib Research Institute and ten kilometers north of the Kuiseb River valley (Figure 1). From the perspective of hunter-gatherers, the Mirabib inselbergs are a very advantageous point on the otherwise open, flat landscape, offering

Figure 1: Mirabib Rockshelter in the central Namib Desert

good views of animal movements over a broad expanse of the Central Namib. The rock outcrops themselves are dotted with small hollows and overhangs which offer protection from sun and strong winds. Though the climate today is one of the most arid regions in Africa with around 50mm of precipitation per year, rare but intense rainstorms in the summer can bring centimeters of precipitation in a short period of time. These events can fill small rock hollows in the Mirabib inselberg, providing a relatively reliable source of water that can persist through the dry season. As a result, endemic animals regularly frequent the area. The combination of water, shelter, and nearby food resources at Mirabib makes it an exceptionally attractive spot in the Central Namib for hunter-gatherers, and likely has been so for tens of thousands of years.

In and around the Mirabib inselberg group, more than a dozen small rockshelters bearing evidence of Late Stone Age human activity lying on the surface can be found. The main rockshelter discussed in this article faces southeast on the edge of the largest rock formation in the group (Figure 2). The rockshelter itself consists of a broad gallery eroded out of a softer schist layer in the granite, creating an overhang approximately fifteen meters deep from the opening to the back wall and about twenty-five meters wide. The sheltered area was originally perhaps as much as 100-200 meters longer than it is today, but a section of the roof to the west of the excavated area collapsed at an unknown time likely before the mid-Holocene, leaving the present relatively small shelter area open. There is a strong possibility that archaeological deposits could be well preserved beneath the enormous blocks of roof fall. Though it would be an extremely large undertaking, excavating underneath the fallen roof material is a tantalizing possibility for future research at the site.

In the area of the rockshelter open currently, excavations were originally undertaken in the early 1970s, led by Dr Beatrice Sandelowsky of the State Museum of South West Africa, now the National Museum of Namibia (Sandelowsky 1974, Sandelowsky 1977). Her team excavated a 14 meter^2 trench down to bedrock from the back of the shelter to approximately the front of the overhanging rock. Her excavations identified at least six natural strata dating between 1.5 ka and 8.0 ka BP. In 2013, a joint team from the University of

Figure 2: Mirabib Rockshelter in the northern Namib-Naukluft National Park

Iowa, Tulane University, and the University of Namibia led by Drs. Ted Marks and Grant McCall opened a new 1 by 1 meter test pit slightly to the east of Sandelowsky's excavation (Marks 2018). The more recent excavations confirmed the stratigraphy from the previous excavations, obtained new dates and artifact samples, and demonstrated that the deposits at Mirabib are significantly deeper in certain areas of the rockshelter than Sandelowsky originally proposed. Our team employed Optically Stimulated Luminescence (OSL) dating, a technique that was not available when Sandelowsky's original excavation took place, to the sediments from the lower layers. As a result, the chronology of the site has been extended as far back as 18 to 21 ka BP, with major occupation phases at around 1.5 ka–5.0 ka BP, 5.6–8.3 ka, and 10.3–12.1 ka BP (Figure 3).

The Late Pleistocene

The lowermost stratum (designated as stratum G) at Mirabib is now dated to about 19.6±1.4 ka BP, during the late Pleistocene. The environmental conditions that prevailed roughly 18–21 ka BP in this part of the Namib are complex and not clearly resolved. There were likely rapid transitions between humid conditions and extreme aridity. However, geomorphological evidence from the nearby Kuiseb River suggests what was perhaps, counterintuitively, a more attractive habitat for humans in the Namib compared to today. The aggradation of the Homeb silt deposits in the Kuiseb and other stream systems in western Namibia supported vegetation and fauna in a long "green corridor" through the desert. Filled in with silt to a higher elevation, the riparian corridor was a relatively wider and more productive habitat than the valley is today (Srivastava et al. 2006, Miyamoto 2010).

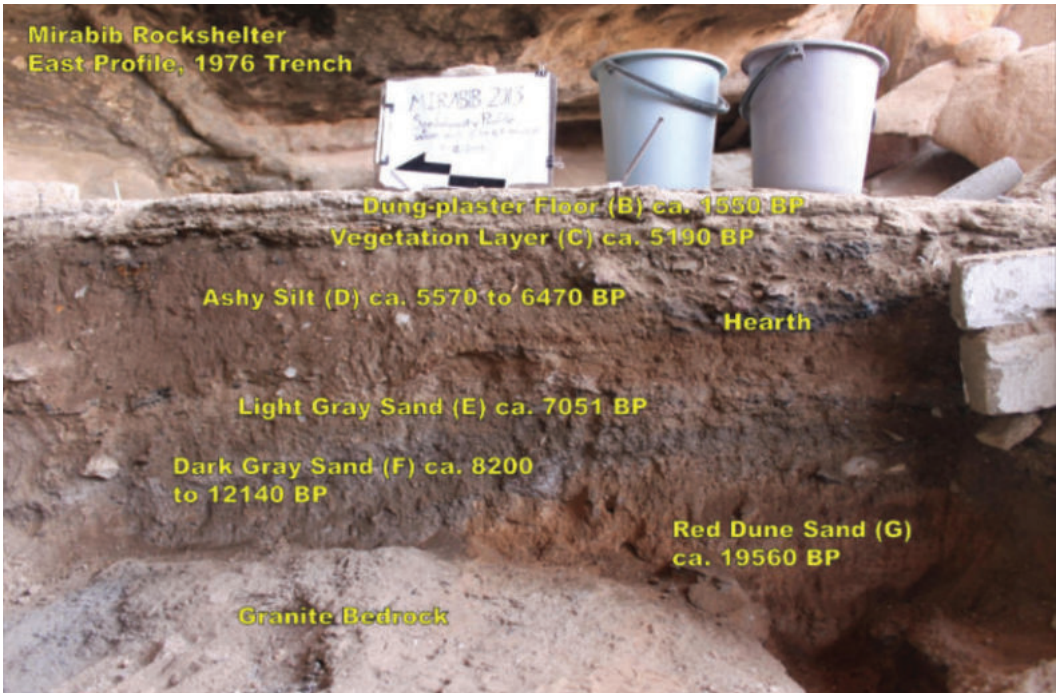

Figure 3: Profile of Sandelowsky's excavation trench reopened in 2013 showing the OSL and radiocarbon ages of the various layers at the site

Pollen from hyrax middens in the same region as Mirabib suggests the vegetation in this period of the late Pleistocene was considerably different than today, with more shrub and woodland pollen compared to the grass that has dominated from the early Holocene to the present. There is also palynological evidence of ferns growing in the region that probably indicate periods of relatively cool and humid conditions (Scott et al. 2004). The sediment matrix of stratum G at Mirabib is made up mostly of red aeolian sand distinct in terms of texture and color from all other layers.The origins and depositional processes of the sand layer are unclear. One possibility is that the sand accumulated as a result of declining vegetation on the landscape immediately surrounding the site that allowed sand to be mobilized by wind. Alternatively, changes in wind regimes could have transported sand from the dune fields of the Namib Sand Sea 20 km to the south of Mirabib. This question requires further investigation: a combination of two or more processes is also possible.

The artifacts from layer G from ca. 18–21 ka BP consist almost entirely of somewhat crude "macrolithic" flakes and debitage. Retouched tools make up less than 3% of the assemblage, with cores making up less than 3% of the assemblage as well (Figure 4, Table 1). At this time period, around 84% of the artifacts were manufactured using clear, glasslike, and very high quality crystal quartz, while much coarser milky vein quartz makes up about 16% of the sample. Both of these raw materials can be found in abundance around

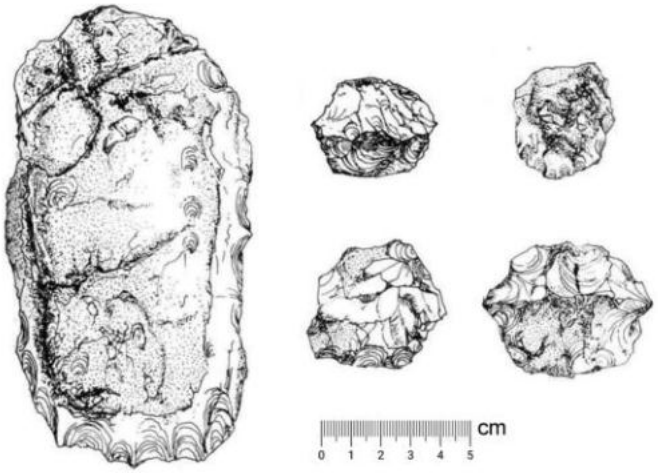

Figure 4: Typical lithics from the late Pleistocene lower levels at Mirabib. Left: scraper. Center/Right: scrapers/discoid cores. Drawings adapted after Sandelowsky (1977)

Mirabib in the form of small pebbles and larger chunks and exposures of hydrothermal quartz veins. Notably, the proportion of milky vein quartz in the lithic assemblage is substantially higher in the late Pleistocene layer than in any other overlying stratum. Knapping techniques were superficially rather crude, with unsystematic multidirectional striking patterns used in order to produce simple 5 to 10 cm flakes from the quartz cores. That said, under virtually any knapping strategy, the proportion of unsystematic multidirectional cores tends to increase in assemblages as the raw material is used to exhaustion. This may point to relatively intensive exploitation of individual pieces of raw material before they were discarded, as well as broader factors related to stone raw material economics that are beyond the scope of this paper (e.g. Andrefsky & Andrefsky 1998).

In comparison to other sites in the region like Erb Tanks Rockshelter (Mccall et al. 2011, Marks 2018) or Apollo 11 (Wendt 1976, Vogelsang et al. 2010), the late Pleistocene

Table 1: Counts of lithic artifacts from the 2013 1x1 meter test pit at Mirabib Rockshelter. Flakes include complete and fragmentary pieces. Cores include unidirectional, multidirectional, centripetal, bipolar, and microblade types. Tools include all retouched and/or utilized pieces.

Stratum	Flakes	Cores	Tools	Grand Total
B	172	4	31	207
C	264	9	3	276
D	4723	163	92	4978
E	1169	39	23	1231
F	1762	62	73	1897
G	202	6	6	214
Grand Total	**8292**	**283**	**228**	**8803**

assemblages recovered from the stratified deposits at Mirabib are sparse and difficult to interpret. No artifacts indicative of specific Middle or Late Stone Age industries such as the Howieson's Poort, Robberg, or Oakhurst industries have been recovered so far from the site. Nevertheless, what has been found indicates at least a limited human occupation of the region and use of the rockshelter by at least 18–21 ka BP. I have previously hypothesized, based on an extensive raw material sourcing study, that during this time populations may have more heavily focused their foraging and mobility patterns into the river valleys themselves as well as in the upland regions to the east of Mirabib. As discussed above, this would be the result of the improved productivity and resource availability of the river valleys around the time of the aggradation of the Homeb silts (Marks 2018). The sparse and low-density late Pleistocene record at Mirabib might therefore be explained by relatively brief and infrequent uses of the site by hunter-gatherers moving around the region. Mirabib at this time may have been located at the edge of groups' annual ranges that tended to be more centered on the riparian corridors and upland regions.

Just outside the rockshelter 100 m to the southeast, there is a large surface accumulation of diagnostically Middle Stone Age tools and flakes. This accumulation has been designated WH-1. As a surface site, the age of WH-1 is not known and it is also unclear whether these artifacts represent a lag deposit or have eroded out of many small rills from a stratified subsurface deposit. Nevertheless WH-1 tentatively suggests that a Middle Stone Age human presence in the area around Mirabib may have been more extensive than is suggested by what has been found in the rockshelter alone. Further investigation of this question is necessary.

The Early to Middle Holocene

In contrast to the late Pleistocene layers, the early to middle Holocene layers (designated strata F, E, and D) at Mirabib dated 5.6 to 12.1 ka BP have produced a dense and diverse assemblage of artifacts that probably signals a very different pattern of intensive residential use of the rockshelter. The total mass of all artifact types rises dramatically in these layers (Table 2) compared to both the underlying and overlying strata. In the series of excavations conducted at the site, well-preserved organic artifacts and debris were recovered along with thousands of lithic flakes, cores, and tools. In the 1x1 m 2013 test pit alone, more than 8000 lithic artifacts, about three kilograms of ostrich eggshell fragments, and more than three hundred grams of tiny bone fragments from small to large sized mammals and birds were found in the early to middle Holocene layers. Seeds from the !nara melon (*Acanthosicyos horridus*) are common in all layers after about 8 ka BP, with isolated examples from as far back as 10–12 ka BP, indicating use of this endemic plant by this early time period. Today !nara plants are semi-domesticated and closely managed as a staple food and source of oil for the Topnaar communities living in the region currently. The presence of !nara at such an early date and its persistence in the record through

Table 2: Total mass of major artifact types from the 2013 1x1 meter test pit at Mirabib Rockshelter. All masses are given in grams.

Stratum	Lithics	Ostrich Eggshell	!Nara Seeds	Fire Cracked Rock	Bone Fragments	Ochre	Total Mass
B	74.5	28.5	1.5	0	19.1	0	**123.6**
C	152.4	51.2	0.3	1.8	9.4	0	**215.1**
D	4669.6	2936.9	2.6	204.7	231.6	0	**8045.4**
E	468.4	77.1	<1	0	50.3	29.2	**625.0**
F	327.2	19.1	<1	2.1	27.6	10.7	**386.7**
G	112.9	0	0	0	18.3	0.1	**131.3**
Grand Total	**5805**	**3112.8**	**4.4**	**208.6**	**356.3**	**40**	**9527.1**

climatic fluctuations in the Holocene suggests a long and complex history of exploitation of this plant which remains poorly understood.

The lithic assemblages in the early to middle Holocene layers at Mirabib are of the typical Wilton type seen across Southern Africa. Tools, as is typical in Wilton assemblages, make up only about 2.3% of the total number of lithic artifacts (Table 1). They consist of backed crescentic microliths, microblades, thumbnail scrapers, drills, and utilized flakes (Figure 5). Cores were struck multidirectionally, bidirectionally, and centripetally, with carefully prepared platforms and ridges set up to produce small bladelets. They are also very tiny, ranging only about 1 to 5 cm in diameter. There are many examples of lithics with heavy coatings of red and yellow ochre. Between 92 and 95% of all of the lithic artifacts in the early to middle Holocene layers are made on very clear and homogenous "crystal" quartz. Pebbles of this material are found in abundance in the immediate vicinity of Mirabib and it is likely that this high-quality stone was an attractive resource exploited by hunter-gatherers in the area. The presence of small amounts of other high-quality lithic raw materials like silcrete, gray chert, and red agate (0.2 to 2% of the total assemblage)

Figure 5: Typical lithic artifacts from the early to late Holocene layers at Mirabib. Top row: crescentic microliths. Bottom row: microblade cores. Drawings adapted after Sandelowsky (1977)

indicate movement and/or trade with more distant regions close to the coast and further to the north (see Marks 2018).

Together with the other non-lithic material from the early to middle Holocene layers, these data suggest that the people who inhabited the area around Mirabib at this time were taking advantage of a wide range of plant and animal resources and were likely using the rockshelter as a primary residential base. Likely climatic conditions at this time were an overall drying trend through the Holocene and a transition to hyper arid conditions similar to today, but punctuated with millennial-scale periods of relatively increased humidity (Chase et al. 2009). Flash floods during dry periods began to erode away the silt deposits in the Kuiseb river (Srivastava et al. 2006), making the long vegetation corridor of the Kuiseb a less attractive and more discontinuous habitat for human groups. At this time across Southern Africa, it is thought that hunter gatherers were probably maintaining more long-term residential base camps at specific points on the landscape where access to water and shelter was more reliable. This is opposed to the typically more mobile pattern of the later Pleistocene wherein people made smaller camps and made frequent moves, but mostly only within relatively restricted landscape zones. This shift to a "hyper-residential" land and site use pattern with a greater degree of logistical foraging (i.e. transporting food and resources back to semi-permanent camps) is typical for many early Holocene sites across Southern Africa. While it is unclear what drove this shift, it does appear to be the context from which the early pastoral communities in this region eventually arose.

The Middle to Later Holocene

The uppermost mid to late Holocene strata, layers C and B, were dated by radiocarbon to ca. 1.5 to 5.2 ka BP. There is a distinct stratigraphic break between layers D and C, transitioning sharply from fine ashy gray sediments in layer D to layer C whose matrix is made up of at least 50% grass and plant material mixed with fine brown silt. In the overlying layer B at or near the modern surface, nearly the entire rockshelter floor is covered by layers of a smooth, hard pavement of dung with intervening layers made up mostly of grass fibers. There are at least two distinct pavements laid on top of each other separated by "subfloor" layers of dry grass. In the pavements, Sandelowsky's analysis tentatively identified sheep hair, suggesting that pastoral communities and likely domesticated stock animals were present in this part of the Namib by at least 1.5 ka BP and possibly earlier. The question of the identification of the sheep hair requires revisiting by a specialist, but if correct it would place Mirabib among other well-known sites suggesting early animal domestication and pastoralism in the wider Namib region, including Leopard Cave, Big Elephant Shelter, and Geduld Rockshelter (Pleurdeau et al. 2012, Wadley 2012, Smith & Jacobson 1995). By this time, the climate had started to steadily deteriorate to dry conditions. This may have impacted the shift in humans' adaptations toward the pastoral economies that have

dominated the region ever since, though the process was obviously complex and a great number of ecological and social factors likely played a role (e.g. Kinahan 1986, Kinahan 1989).

It is still unknown whether the dung pavement layers were deliberately laid down by people as a firm and impermeable living surface or whether it perhaps simply accumulated from animals that were being corralled in the rockshelter. The smoothness and layering of the pavements suggests the former interpretation. In either case, the impermeable pavement has served as an excellent seal on the underlying strata that has prevented water, plant roots, and fossorial animals from disturbing the archaeological deposits below. In addition to its preservative function, the dung and grass layers themselves have yielded a truly unique assemblage of late Holocene artifacts (Sandelowsky 1977). These include, among others, a variety of leather pieces, grass cordage, ochre-encrusted human hair, copper beads, stone pendants, and gourd rattles. Bone artifacts include points, beads, and arrow linkshafts, many of them coated in red and yellow ochre. Fragmentary faunal remains, including parts of hoofs and horns from medium and large ungulates were recovered as in the underlying layers. Worked wooden artifacts are particularly well preserved and include beads and weapon hafts with their original cordage wrappings intact. Seeds from the !nara melon are again also very common, continuing the evidence of heavy exploitation of this endemic plant for food. Pottery is present in these layers but rare, and made up only of small fragments of low-fired and coarse sand-tempered fragments from clay probably sourced from the Kuiseb River. Stone artifacts in the late Holocene layers are likewise characteristic of the Wilton microlithic industry as seen in the early to middle Holocene layers. This includes large numbers of backed crescentic bladelets, multidirectional and bipolar microcores, and thumbnail scrapers dominating the tool assemblage. There are likewise large quantities of flaking debris, although in lower density than in underlying layers. As in the early to middle Holocene, fine crystal quartz makes up the overwhelming majority of the raw material, with very small quantities of silcrete, gray chert, and agate. Strong similarities across various aspects of the lithic technology at Mirabib indicates its persistence through thousands of years, multiple climatic fluctuations, and the shift towards pastoral economies in the region.

Conclusions

In summary, Mirabib represents one of the most important archaeological records presently known from the Central Namib gravel plains region. At Mirabib, we see evidence for human adaptations shifting between strategies focused on hunting and gathering in rich riparian corridors, to more dispersed and intensive occupation of the open gravel plains, and finally towards pastoralism. Nevertheless, this area of Southern Africa has been sparsely researched over the recent decades, and a great deal more work needs to be done. This includes further excavation of the large unexplored area of the site and

high resolution dating to better link occupational events and regional climate conditions. The unique environmental conditions presented significant challenges to human life in the region over the past 20,000 years, but the superb preservation and high resolution record at Mirabib offers archaeologists an excellent test case for evaluating hypotheses about human adaptive flexibility in the late Pleistocene and Holocene.

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