

Early Maritime Desert Dwellers in Namaqualand, South Africa: A Holocene Perspective on Pleistocene Peopling

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ABSTRACT

South Africa's northern Namaqualand coastal desert is the southern extension of the Namib. Today, this region is semi-desert with patchy subsistence resources and scarce, unpredictable rainfall. Yet this ancient desert landscape possesses residues of human activity stretching back into the Middle Pleistocene, evidenced by heavily weathered surface finds, including handaxes and Victoria West cores. Such old finds in so harsh an environment raise important questions: how do human movements into this area relate to local palaeoenvironmental changes, and how has this relationship changed through time? While no dated Middle Pleistocene sites presently exist to reconstruct the earliest hominin dispersals, several late Pleistocene sites now have chronostratigraphic sequences that can be brought to bear on these questions. This article presents chronological and subsistence-settlement data for one such site, Spitzkloof A Rockshelter in the northern Namaqualand's rugged Richtersveld. Humans are shown to have visited the site very sporadically between ~50,000 and 17,000 cal BP. Unlike most of the subcontinent, the most intensive occupations occur during early Marine Isotope Stage 2, when multiple proxies suggest enhanced humidity associated with intensified winter rainfall. We examine these data using the region's better-developed Holocene archaeological record to create predictions about the earliest coastal desert dwellers.

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INTRODUCTION

Relative to the Mediterranean-like coastal ecosystems of the southern and western Cape, southern Africa's drier coastal zones remain archaeologically under-investigated. Moving north from the Cape along southern Africa's west coast, environments become increasingly water-stressed, culminating in the hyper-arid Namib Desert, the sand seas of which drape the Skeleton Coast. Between the Cape and the Namib lies the Namaqualand coastal desert of northwestern South Africa, a semi-arid landscape of dynamic coastal sand dune systems flanking ancient, heavily degraded mountain chains. Like other coastal deserts worldwide, Namaqualand would have presented prehistoric foragers (and, in the last 2,000 years, herders or herder-foragers) with a mix of terrestrial resources that were unpredictable in space and time and much more stable littoral and marine foods along the adjacent shoreline. Exploitation of the latter has generated what are by far Namaqualand's most visible archaeological signatures—hundreds (and likely thousands) of coastal shell middens in Holocene dunefields, dozens of which have been documented in the course of cultural resource management mitigations of the region's voracious open-cast diamond mining operations.

By contrast, virtually nothing is known about Namaqualand's inland archaeological record, which includes diagnostic artifacts suggesting human occupation of this parched region extended deep into the Middle or perhaps Lower Pleistocene (Dewar and Stewart 2016). Considering Africa's key role in charting human behavioral evolution, an understanding of the timing, motives, and modes of human dispersals into challenging environments like Namaqualand can provide us with fundamental insights into biogeographical processes that complement other measures of adaptive change, such as technological and subsistence innovations and the proliferation of non-utilitarian technologies

(e.g., Clark and Kandel 2013; d'Errico et al. 2005; Henshilwood et al. 2002, 2009; Texier et al. 2010; Wadley 2010, 2013; Wadley et al. 2009). Our research goal is to identify the tempo, nature, and causes of early human occupation in the region. Related to this, what was the environment and thus the available resource like, and which biocultural innovations allowed people to adapt to that niche? In this article, we use the region's better developed Holocene archaeological record to create predictions about these questions as they apply to early coastal desert dwellers. We evaluate these predictions using palaeoenvironmental and subsistence-settlement data derived from faunal assemblages at Spitzkloof A, a late Pleistocene rock-shelter sequence in inland Namaqualand on which our work has focused (Dewar and Stewart 2012, 2016).

NAMAQUALAND: LANDSCAPE AND ENVIRONMENT

The Namaqualand coastal desert is known for its spectacularly strange and desolate landscapes, its extraordinarily diverse plant and animal life, and, though today the local inhabitants are generally impoverished, its immense mineral wealth. The majority of the region's inhabitants live in remote towns built by the open-cast diamond mining industry or small villages, sedentary centers of the region's previously transhumant Nama-speaking pastoralist population. Namaqualand's rocky hinterland is a biodiversity hotspot for low-lying succulents and small reptiles (Desmet 2007), while open-air shell middens in mostly Holocene-age dune systems cover the coastline between the scars of diamond pits scoured into paleo-riber channels.

Today, minimum temperatures in winter fall below 0°C and dry summer heat reaches above 40°C when evapotranspiration exceeds precipitation and the only

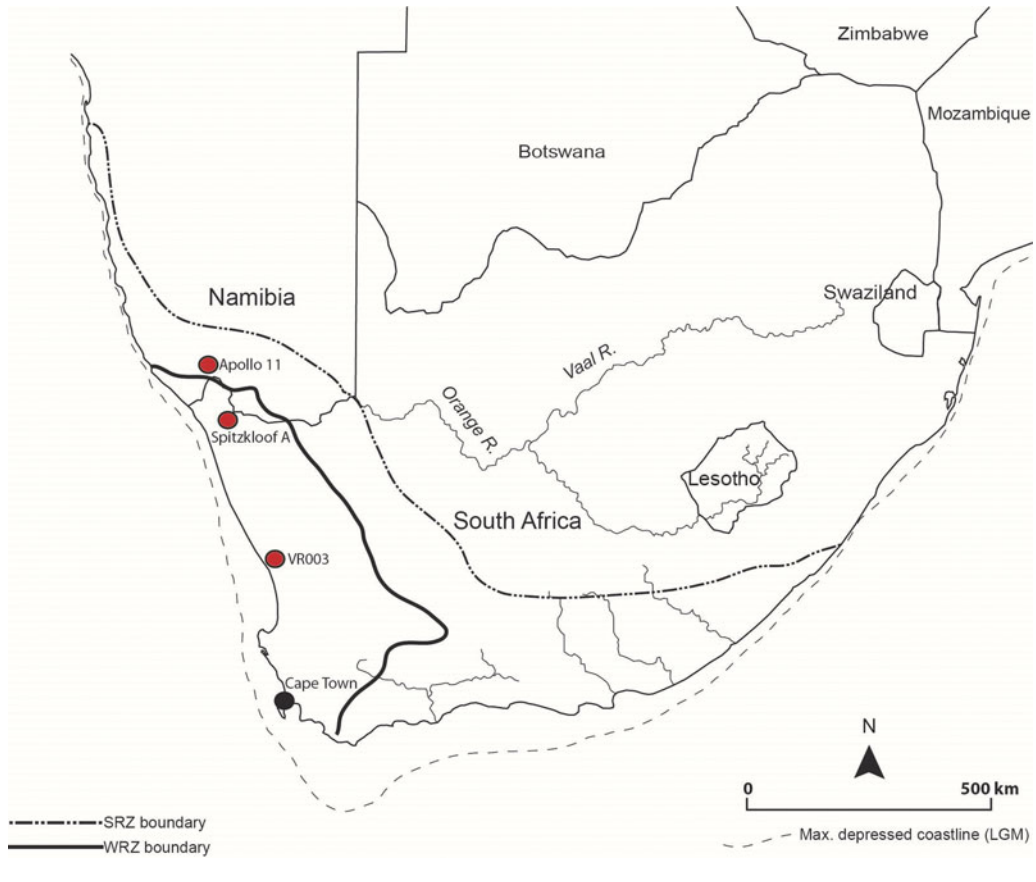


Figure 1. Map of South Africa showing the geographic location of the rockshelters Spitzkloof A, Apollo 11, and V003. The boundaries of the Winter Rainfall Zone, Summer Rainfall Zone, and the extent of the continental shelf during the last glacial maximum (LGM) are shown as lines.

source of water are coastal fogs with relative humidity levels of between 70% and 100%. Rain is infrequent, but seasonally predictable in that more than 66% of the annual precipitation falls in the austral winter months. However, precisely where rain falls on the landscape is extremely erratic. Mean annual rainfall is low, ranging from 150 mm at the Olifants River, which delineates the region's southern boundary, to 50 mm at the Orange River in the north (Figure 1). This range of precipitation values defines the region today as semi-arid. Namaqualand can thus be seen as a transitional zone between the hyper-arid Namib Desert to the north and

South Africa's relatively well-watered Western Cape Province to the south.

Namaqualand's aridity is exacerbated by the meeting of frigid upwelled ocean waters with the hot, dry air of the subsiding subtropical cell. Cold upwelling waters of the Atlantic Benguela Current produce sea surface temperatures ranging from 11°C to 17°C (Eitel 2005). This cools a thin layer of surface air, impeding convection and preventing precipitation. The result is a rain shadow effect (Mucina and Rutherford 2006) extending some 30 km inland, where fine-grained sand deposits and quartz gravel plains eventually meet the foothills of the Stinkfontein

Mountain group and precipitation can reach 250 mm per annum. As the Benguela Current was established in the late Miocene 7 to 10 mya (Deacon and Lancaster 1988; Eitel 2005), this coastal desert has likely varied from hyper-arid to semi-arid over time, but has overall maintained its desert-like characteristics (Eitel 2005). The northern and southern boundaries of Namaqualand are marked by the only two rivers with year-round flow. The Orange River with its headwaters in the Maloti-Drakensberg Mountains of southeastern southern Africa (Stewart et al. 2016), over 1500 km east of Namaqualand, receives input from predominantly summer rains, while the Olifants River to the south receives winter rainfall flow from the near-coastal Cederberg Mountains. Five additional riverbeds bisect the coastal plateau, yet only flow in years with well above average winter rainfall, although the estuaries of two—the Buffels and Spoeg—do contain permanent standing water.

Given the scarcity of available water in the region, the flora and fauna are necessarily arid-adapted specialists with many of them endemic to Namaqualand. The distribution of plants and animals is also unpredictable and patchy due to shifting rainfall patterns (Desmet 2007). This area is a Succulent Karoo biome dominated by dwarf succulent shrubs; Aizoaceae are prominent, as are Euphorbiaceae, Crassulaceae, and succulent members of Asteraceae, Iridaceae, and Hyacinthaceae (Mucina and Rutherford 2006). Extravagant mass flowering of Asteraceae daisies occurs in spring, transforming the barren landscape into a mosaic of rich colors. Sweet, palatable grasses are rare, while spiny grasses are common on aeolian dunes; trees such as *Acacia karroo* are present only along riverbanks. The larger non-domestic fauna includes remnant herds of springbok (*Antidorcas marsupialis*) and gemsbok (*Oryx gazella*), while smaller solitary species include steenbok (*Raphicerus campestris*), duiker (*Sylvicapra grimmia*), klipspringer (*Oreotragus oreotragus*), Cape hare (*Lepus capensis*), rock hyrax (*Procavia capensis*), Namaqualand speckled padloper (*Homopus signatus signatus*), Namaqua tent tortoise (*Psammobates ten-*

torius trimeni), and angulate tortoise (*Chersina angulata*). Historical sources indicate that much larger species were once supported on the landscape, including elephant (*Loxodonta africana*), hippopotamus (*Hippopotamus amphibious*), black rhinoceros (*Diceros bicornis*), eland (*Taurotragus oryx*), zebra (*Equus quagga*), and Cape buffalo (*Syncerus caffer*), as recorded by early colonial traveler Robert Gordon commenting on his sojourn to the Orange River from Cape Town in September 1779 (Cullinan 2006; Skead 1980). The paucity of large herbivores on the landscape today is partially due to the degradation and loss of vegetation and soil quality through overgrazing by domesticated animals as seen in other regions of South Africa (Hoffman et al. 1999). Ironically, however, the mining industry actually preserved the natural landscape as only 10% of the region was available to grazing animals (Desmet 2007). As such, researchers must also look for evidence of shifting environments and overhunting to explain the drastic reduction in large herbivores on the landscape today.

In his travels, Gordon also met many local indigenous people on his journey through Namaqualand, including “kleine Nama” pastoralists and “Bushman” foragers (Cullinan 2006). Thousands of shell middens along the coastal plateau confirm Gordon’s observations that the region was more heavily occupied in the past, at least at certain times (Dewar 2008).

EARLY OCCUPATION OF NAMAQUALAND: INSIGHTS FROM THE HOLOCENE

Gordon visited Namaqualand during a particularly wet period at the end of the Little Ice Age, yet he continuously lamented the lack of available freshwater and large trees for fuel to stave off the colder temperatures (Cullinan 2006). An image painted by one of Gordon’s companions is very telling of how the local “Bushmen” managed to survive when freshwater was rare: women carry net bags full of ostrich eggshell flasks, watertight containers that can be plugged and buried for future

use (Cullinan 2006:gallery page 15). So the ability to source, cache, and carry water was clearly important historically.

In terms of archaeological research, the general picture is still in its infancy. To date, just over 100 sites and burials have been excavated, with a total of 108 radiocarbon dates. The vast majority (91%) represent Holocene occupations (Dewar and Orton 2013). However, these dated sites represent less than 5% of known sites, with the majority representing shell middens situated within a kilometer of the current coastline (Dewar 2008; Dewar and Orton 2013). Moreover, with a dynamic marine environment including shifting sea levels and marine dunes there are likely to be many more sites both underwater and deeply buried beneath terrestrial sediments. Archaeological survey has recorded diagnostic stone tools that identify a human presence stretching back into the Early Stone Age (1.8 mya–250 kya): numbers of handaxes and Victoria West cores have been identified in the region, typically at silcrete quarries and/or as isolated occurrences along river terraces. It is extremely difficult to interpret such finds beyond inferring that they likely represent relatively short-lived incursions by very small hominin groups. Indeed, their extremely low densities in unstratified contexts render them unsuitable for addressing questions of when humans first dispersed into Namaqualand, what palaeoenvironmental conditions prevailed at the time, or whether arid-environment adaptations were necessary for its exploitation.

These questions are the focus of two recently initiated, ongoing research projects investigating rockshelter sites that provide deep chronologies and palaeoenvironmental sequences: the Spitzkloof shelters in northern Namaqualand (Dewar and Stewart 2011, 2012, 2016) and Varsch Rivier 3 (VR003) in southern Namaqualand (Steele et al. 2012). Unlike open-air midden sites, virtually no work has previously been undertaken in rockshelters in Namaqualand, and none whatsoever on shelters with Pleistocene deposits. Our understanding of the timing, motives, strategies, and processes by which people first began living in this landscape is therefore nascent. We can, however, use the more substantial and better-resolved

datasets from the Holocene occupation of the region to model subsistence and settlement strategies and to predict which environmental conditions would have been suitable for supporting continuous occupation of the region.

The Holocene occupation of Namaqualand was pulsed, with palaeoenvironmental proxies indicating that people primarily lived in the region when it was colder and wetter than present day (Dewar 2008; Dewar and Orton 2013; Dewar and Stewart 2012, 2016). The main periods of occupation during the Holocene occurred during the Neoglacial period from 4200 to 1400 BP and the Little Ice Age from 650 to 150 BP (Dewar and Orton 2013). While there is some evidence of light occupation during the mid-Holocene Altithermal (7000 to 4200 BP) and the Medieval Warm Epoch (1390 to 650 BP), these warm and dry periods are mainly represented by isolated human burials (Dewar 2008; Dewar and Orton 2013). Access to freshwater is the most likely limiting factor, with ostrich eggshell flasks present in archaeological assemblages through the Holocene, although sites were unexpectedly untethered to rivers (Dewar 2008). Cold and wet periods would have been beneficial to the food chain, increasing grass coverage and attracting larger game to riverine and inland locations.

During the Neoglacial subsistence and settlement patterns indicate an opportunistic residential foraging strategy (see Binford 1980; Rowley-Conwy 1999, 2001) focusing on the immediate vicinity of sites. Archaeological sites have produced a relatively high diversity of faunal species, reflecting a generalized diet focusing on small meat packages (Dewar 2008). Low-ranking species that dominate these assemblages include easily snared or trapped small bovids, tortoises, and shellfish. Sites are small, single occupation processing areas or kill sites where primary butchery was practiced and the best cuts of meat taken elsewhere. Group sizes were either very small and people highly mobile, or else base camps have yet to be identified (Dewar 2008). Maintaining clothing was clearly important as most deposits include bone needles or awls, as well as the remains of pelt-bearing species including black-backed

jackal (*Canis mesomelas*) and bat-eared fox (*Otocyon megalotis*).

There seems to have been a population crash in Namaqualand from 1400 to 650 BP corresponding to the Medieval Warm Epoch, but with the onset of the Little Ice Age the region rebounded and people again become archaeologically visible. When humans returned to Namaqualand they continued to practice an opportunistic residential foraging strategy focused on the immediate surroundings of the sites they occupied. A relatively high diversity of species reflects a generalized diet, yet based on the available calories an unusual pattern is evident in which both low-ranking and high-ranking species dominate the assemblages. Additionally, we see the introduction of mass harvesting of lower ranked species, suggesting an overall subsistence strategy with significant processing (mass harvesting small bovids, penguins, rock lobster known locally as crayfish) (Dewar 2008; Dewar et al. 2006) and search costs (hunting large bovids). Base camps appear at the coast and include examples of site “furniture” (large elaborate grindstones, see Dewar and Orton 2013) and evidence for a social division of labor, including high frequencies of exchange items such as ostrich eggshell beads and pendants and marine shell pendants. Either populations were much larger or people were staying for extended periods of time since the mean size of shellfish taken drops, implying a degree of pressure on available resources (Dewar 2008). Maintaining clothes continued to be important, with sewing tools and now also high frequencies of small and large antelopes and penguins available for both meat and pelts.

The above synthesis of the Holocene evidence from Namaqualand makes it tempting to categorize the region as a more predictable and plentiful environment during cold wet phases. Yet the behaviors registered in the archaeological record are characteristic of human adaptations to relatively unpredictable desert environments (see Smith 2005; Veth 2005; Yellen 1977). For example, people appear to have had: (1) high degrees of mobility, (2) generalist broad (opportunistic) subsistence strategies, (3) flexible social organizations, and (4) open inter-group

boundaries with little territoriality (see Dewar 2008). Taken together these traits suggest that the environment was still patchy and unpredictable in terms of its distribution of water and other resources.

PREDICTED USE OF THE PLEISTOCENE LANDSCAPE

The subsistence and settlement data presented above for the Holocene provide some patterns that can be used to model or predict Pleistocene dispersals and landscape use. First, it is clear that increased human occupation of Namaqualand during the Holocene correlates with phases when the region was colder and wetter than present day. Based on palaeoenvironmental studies of the winter rainfall zone (Chase and Meadows 2007; Dewar and Orton 2013; Dewar and Stewart 2016), glacial periods should produce evidence for more intense occupation, as this is when this desert region was also the most humid. Unfortunately, regressing shorelines during glacials means that coastal sites from those periods are currently submerged, but inland sites could still be preserved. Colder periods with greater moisture availability would have been beneficial for the growth of grasses providing fodder for large prey in inland regions. Recall that it was at the end of the Little Ice Age that Gordon visited Namaqualand, and his observations make clear that the landscape at that time could support large grazers. Second, during these cool Holocene occupational phases, people seemed to have maintained fairly high levels of mobility following a residential foraging pattern. They focused on species in the immediate vicinity of their encampments, especially during mass harvesting episodes in the Little Ice Age, but overall maintained a broad generalist diet. Using Gordon’s historical observation, we would also expect to see the use of ostrich eggshell flasks as water containers since they were vital to hunter-gatherers even during the Little Ice Age, a considerably wetter period than today.

We now turn to northern Namaqualand and the recent excavation of Spitzkloof A Rockshelter (28° 51.790’S 17° 04.65270’E)



Figure 2. Photograph of Spitzkloof Rockshelters showing the three hollow domes and the dry tributary. The shelters are identified upwards as A through C.

located in the foothills of the front range of the Stinkfontein Mountains. Today, Spitzkloof A is an inland site 30 km east of the Atlantic Ocean and 30 km southwest of the Orange River (Figure 1). It is the largest of three sequential domed shelters on the west side of a deeply incised dry riverbed of a tributary of the Holgat River (Figure 2). The excavated deposit is currently 2.0 m deep,

though it has not yet reached bedrock, and has produced well-preserved organic material, including charcoal, bone, and ostrich eggshell.

RESULTS AND DISCUSSION

Chronology

The calibrated radiocarbon ages currently available from Spitzkloof A range from 17 ka cal BP at the surface to 52 ka BP at a depth of 1.45 m below it (Table 1, Dewar and Stewart 2016). Unfortunately, the bottom 0.55 m remain undated as these levels are beyond the radiocarbon limit, and the surrounding bedrock is so ancient (>4 billion years ago) and radioactive that the quartz electron traps here are saturated, preventing the use of optically stimulated luminescence (OSL). However, a study is currently underway to address this issue and hopefully basal dates can be obtained in the near future.

Based on a suite of 10 radiocarbon dates on ostrich eggshell, the nature of occupation of Spitzkloof A was clearly pulsed, with layers dated at 52 to 51 ka BP, 23 ka cal BP, 19 ka cal BP, 18 ka cal BP, and 17 ka cal BP

Table 1. Radiocarbon ages from Spitzkloof A, Namaqualand, South Africa (Dewar and Stewart 2016). Dated samples consisted of inorganic calcium carbonate from ostrich eggshell.*

Lab no.	Context	Date in ¹⁴ C BP	Calibrated dates BP
UBA-17609	Layer Nick	14,350 ± 10	17,270–17,090
UBA-17610	Layer Nick	14,400 ± 70	17,390–17,130
UBA-17611	Layer Nadja	15,200 ± 50	18,300–18,110
UBA-17612	Layer Jaird	16,250 ± 60	19,460–19,240
UBA-17613	Layer Dave	19,550 ± 60	23,420–23,130
UBA-17614	Layer Mark	19,750 ± 80	23,670–23,390
UBA-17615	Layer Julie	19,550 ± 60	23,420–23,130
UBA-17617	Layer Brian	52,150 ± 800	N/A
UBA-17618	Layer Brian	51,150 ± 850	N/A
UBA-17616	Layer Brian	>59,250	N/A

*Experiments have shown that fossil ostrich eggshell is typically 180 ± 120 years too old (Vogel et al. 2001) and so 180 years were subtracted before calibration. Dates were calibrated using the software Calib 7.0 and the calibration curve Shcal13.14c for the Southern Hemisphere (Hogg et al. 2013). Note that the geological layers Dave, Mark, and Julie represent a single chronological layer.

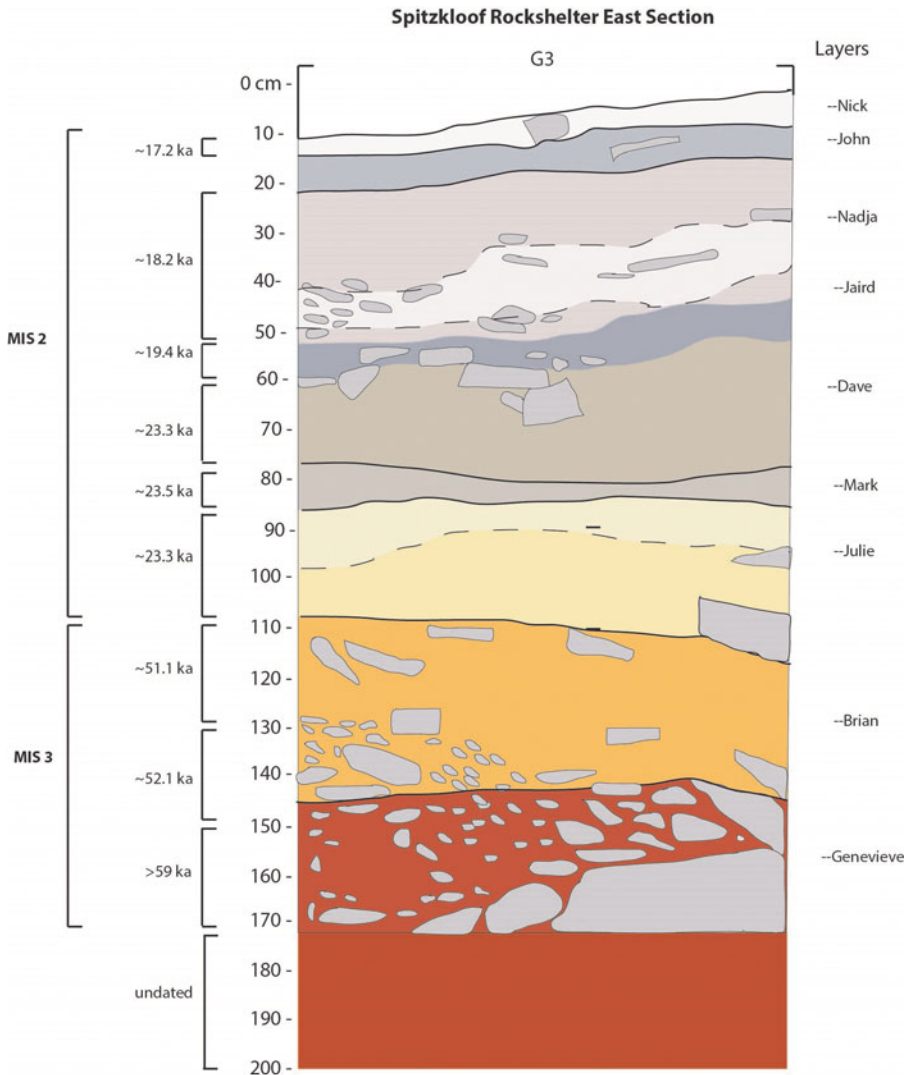


Figure 3. Profile of the east section of unit G3 from Spitzkloof A Rockshelter with the associated calibrated radiocarbon dates. The various colors identify the gross layer boundaries of the deposit.

(Table 1, Figure 3). The thickest deposits with potential for continuous occupation are the bottommost radiocarbon-dated layers (52–51 ka BP and 23 ka cal BP), indicating that people had indeed colonized the region by the Middle Stone Age (MSA). The uppermost layers, ranging from 19 to 17 ka cal BP,

may indicate a particularly sustained occupation of the site (Table 1, Figure 3).

The radiocarbon chronology for Spitzkloof A confirms that people occupied northern Namaqualand during periods that were wetter and colder than today based on a range of palaeoenvironmental proxy data

(Table 2, summarized in Dewar and Stewart 2016). More specifically, these dates reflect occupation during Marine Isotope Stages (MIS) 3 (57 to 29 ka) and 2 (29–14 ka) respectively, periods that appear to have witnessed considerable climatic and population instability across much of the southern Africa (Beaumont 1986; Mitchell 1990, 2002). The nearest comparative site is Apollo 11 at roughly 120 km due north, located within the desert biome. Recent amino acid racemization dates identify two very old occupation pulses with minimal ages of $180,000 \pm 10,000$ years and $236,000 \pm 18,000$ years and a MIS 5a date of $80,000 \pm 12,000$ years (Murray-Wallace et al. 2015). These data support the previously published ^{14}C and OSL dates that suggest Apollo 11 was also occupied sporadically (Vogelsang et al. 2010). More importantly, Apollo 11 has also produced deposits dating to MIS 3 and 2. However, during MIS 3 the occupation of Apollo 11 is not in sync with Spitzkloof, with OSL dates at 58 ± 3 ka (AP9), 57 ± 3 ka (AP3), 43 ± 3 ka (AP2), and 30 ± 1.4 ka (AP11) (Vogelsang et al. 2010), suggesting regionally complex patterning (Mackay et al. 2014). MIS 2 dates are more similar between the two sites with recurrent pulses from 22 to 17 ka (Dewar and Stewart 2016; Vogelsang et al. 2010). Of note is the temporary abandonment of both shelters during the height of the Last Glacial Maximum (LGM), perhaps indicating that the area was simply too cold even if moisture availability was then high. As our most robust evidence for the occupation of Namaqualand is at 52–51 ka BP and 23 ka cal BP, we now evaluate the evidence for subsistence and settlement from those deposits.

Subsistence and Settlement

During the 52–51 ka BP occupation, the people inhabiting Spitzkloof A utilized a relatively broad range of species ($n = 16$) dominated by small meat packages (Table 3). Although compared to the coast and better watered regions further south, the diversity of species is quite low (see Dewar 2008). Based on the number of identified specimens (NISP), small fur-bearing mam-

mals, tortoises, and large ungulates dominate the assemblage in that order (Dewar and Stewart 2012). While all identified species would have been available in the immediate vicinity of the site, only the rock hyrax prefers rocky terrain, with all other identified species preferring plains or sand dunes. Together, these data reflect a residential mobility foraging strategy focusing on the immediate surroundings (see Binford 1980; Rowley-Conwy, 1999, 2001). Based on NISP, the majority of animals brought back to the site were small, easily snared, trapped, or picked up, characteristics that make all of them low-ranking species in terms of available meat and low search costs. The presence of a Size 4 (296 to 900 kg; see Brain 1981) ungulate indicates the active hunting of at least one large high-ranking species. Evaluating the proportion of large to small animals, the large ungulate index ($\Sigma\text{NISP medium} + \text{large ungulates} / \Sigma\text{NISP small} + \text{medium} + \text{large ungulates} * 100\%$) shows a low representation of the highest ranked species at 16% of the ungulates. This confirms that people practiced a broad diet with a high contribution of small mammals and tortoises. However, applying optimal foraging theory (Bettinger and Baumhoff 1982; Charnov 1976; Kelly 1995) and calculating the available kilojoules based on the minimum number of individuals (MNI) present in the assemblage (Table 3), the two large ungulates (a gemsbok and a zebra-sized ungulate) provided 65% of the total energy available, while the small mammals/bovids together contributed 34% and the tortoises <1%. This assemblage suggests a subsistence strategy that included both hunting the highest ranked species and following a broad generalized diet. The subsistence strategy for the albeit younger MIS 3 layers at Apollo 11 is similar with evidence for a broad diet based on local species and a high frequency of large ungulates (Dewar and Stewart 2012). Differences in available prey between the sites are based on local geology and ecology with more rocky loving species, fewer tortoises, and a higher proportion of zebra at Apollo 11 (Dewar and Stewart 2012, 2016; Thackeray 1979; Vogelsang et al. 2010).

Table 2. The proxy palaeoenvironmental data for Marine Isotope Stages 3 and 2 as presented in Dewar and Stewart (2016), the associated dates, implications, and sources of the data. The dates are presented as they were in their published form while the calibrated dates column reflects calculations for Dewar and Stewart (2016).

				Calibrated dates at 1σ cal BP (for this study) ²	Reference
Marine isotope stage 3: Stadial 57–29 ka	Data	Signal	Date	Implication	Reference
	OSL and charcoal	Apollo 11: Single species of Xenic taxa Chenopodiaceae during occupation hiatus	Between 57.9 ± 2.6 ka (AP3) and 42.9 ± 2.7 ka (AP2)	Arid	Vogelsang et al. 2010
	Pollen ¹	Decreasing but fluctuating levels of Restionaceae and desert/semi-desert species	~57–50 ka	Drying?	Shi et al. 2001
Southern Cape sea level	Paleoscape model: Bathymetry and GIS ¹	Coastline shifts to ~18 km from the modern shore	~57–40 ka	Slight regression	Fisher et al. 2010
Southern Cape sea level	Strontium isotopes	Slight decrease in $^{87}\text{Sr}/^{86}\text{Sr}$ ratios	~55 ka	Slight transgression	Fisher et al. 2010
	Pollen ¹	Increasing proportion of Restionaceae and desert/semi-desert taxa with a peak at 32 ka	50–29 ka	Increasing humidity	Shi et al. 2001
Southern Cape sea level		Steady increase in $^{87}\text{Sr}/^{86}\text{Sr}$	~55–27 ka	Regression	Fisher et al. 2010
	Terrigenous sediments ¹	Rapidly fluctuating aeolian dust input and trade winds		Instability?	Stuut et al. 2002
	^{14}C on ostrich egg-shell, fauna and gypsum	SpitzA arid adapted species, primarily browsers but Gemsbok suggests some grass; Gypsum crystals present	~52–51 ka	People on the landscape in a (semi-arid) modern-like environment but with increased humidity	Dewar and Stewart 2012, 2016

Eastern Cape sea level	¹⁴ C dated wetland peats	-52 m a.m.s.l. lowstand	45,200 ± 2,000 ¹⁴ C BP (Pta-4140)	49,970-47,070	Regression	Ramsay and Cooper 2002
	¹⁴ C on ostrich eggshell and fauna	Boegoeberg1: Large hyenas and water-dependent grazing species	37,220 ± 5,010 ¹⁴ C BP (GX-22191)	45,430-36,160	Cool/humid with grass	Klein et al. 1999
Eastern Cape sea level	¹⁴ C dated wetland peats	-46 m a.m.s.l. lowstand	39,100 ± 1,530 ¹⁴ C BP (Pta-4142)	44,290-41,880	Regression	Ramsay and Cooper 2002
	Amino acid racemization dates on eggshell	Erb tanks	45 ka		Presence of people on the landscape	McCall et al. 2011
	OSL	Apollo 11	43 ± 3 ka (AP2)		Presence of people on the landscape	Vogelsang et al. 2010
	¹⁴ C on ostrich eggshell and fauna	Boegoeberg1: Large hyenas and water-dependent grazing species	34,990 ± 3,110 ¹⁴ C BP (GX-21190)	42,060-36,100	Cool/humid with grass	Klein et al. 1999
	¹⁴ C on ostrich eggshell and fauna	Boegoeberg1: Large hyenas and water-dependent grazing species	33,230 ± 2,630 ¹⁴ C BP (GX-21189)	40,120-34,760	Cool/humid with grass	Klein et al. 1999
Southern Cape sea level	Paleoscape model: Bathymetry and GIS ¹	Slight shift to ~10 km from modern shoreline	~40 ka		Shallow transgression	Fisher et al. 2010
	Calibrated ¹⁴ C dates	Apollo 11 occupational pulses	~37 cal BP		Presence of people on the landscape	Vogelsang et al. 2010
	Paleoscape model: Bathymetry and GIS ¹	Coastline moves to ~25 km from modern shore	~32 ka		Slight regression	Fisher et al. 2010
Southern Cape sea level	Calibrated ¹⁴ C dates	Apollo 11 occupational pulses	~32-29 cal BP		Presence of people on the landscape	Vogelsang et al. 2010
	¹⁴ C dated peat bed	Peat bed at Kannikwa near Port Nolloth	27,900 ± 310 ¹⁴ C BP	32,000-31,270	High humidity	Beaumont 1986

(Continued on next page)

Table 2. The proxy palaeoenvironmental data for Marine Isotope Stages 3 and 2 as presented in Dewar and Stewart (2016), the associated dates, implications, and sources of the data. The dates are presented as they were in their published form while the calibrated dates column reflects calculations for Dewar and Stewart (2016). (Continued)

Marine isotope stage 3: Stadial 57–29 ka	Data	Signal	Date	Calibrated dates at 1σ cal BP (for this study)²		Reference
Orange River Mouth sea level	¹⁴ C marine shell	-78.4 m a.m.s.l. lowstand	27,800 ± 440 ¹⁴ C BP (Pta-1104)	30,880–31,510 ⁴	Regression	Vogel and Visser 1981
	OSL and fauna	Apollo 11: Arid adapted species + equids and warthog (grazers)	30 ± 1.4 ka (AP11)		Landscape is slightly more humid than today. Some grass available?	Vogelsang et al. 2010
Southern Cape sea level	Paleoscape model: Bathymetry and GIS ¹	Shore returns a few km to ~22 km from modern coast	~30 ka		Shallow transgression	Fisher et al. 2010
Marine isotope stage 2: Last Glacial Maximum 29–14 ka	Data	Signal	Date	Calibrated dates at 1σ cal BP (for this study)²		Reference
Eastern Cape sea level	Durban Bay: ¹⁴ C dated wetland peats	-22 m a.m.s.l. stand	24,950 ± 950 ¹⁴ C BP (GaK-1390)	29,950–28,000	Transgression	Ramsay and Cooper 2002
	Pollen and charcoal	Elands Bay Cave: Woodland taxa peak and xeric taxa minimum and drought intolerant species	20.5 to 17.8 ¹⁴ C kBP	~25,100–24,310 to 21,910–21,110 ³	High humidity	Meadows and Baxter 1999
	Pollen ¹	Peak percentage of Restionaceae	~24 ka		High humidity	Shi et al. 2001

(Continued on next page)

Terrigenous sediments and trade wind proxies ¹	Peak fluvial activity and trade winds	~24 ka	High humidity	Stuut et al. 2002
¹⁴ C Hyrax dung Pollen	<i>Olea</i> , <i>Stoebe</i> type, <i>Artemisia</i> , and fern pollen co-occurring with dwarf shrubs	17,000 ± 190 ¹⁴ C BP (Pta-8902)	Cool and moist or increased evapotranspiration	Scott et al. 2004
Southern Cape sea level	¹⁴ C <i>Pecten</i> sp. shell	16,990 ± 160 ¹⁴ C yrs BP (Pta-182)	Last Glacial Maximum peak	Vogel and Marais 1971
Pollen ¹	Restionaceae percentages declining	~19–14 ka	Declining humidity	Shi et al. 2001
Terrigenous Sediments and trade wind proxies ¹	Fluvial activity and trade wind curves declining	~19–14 ka	High humidity declining through time	Stuut et al. 2002
Orange River Mouth sea level	–87.2 m a.m.s.l. lowstand	16,100 ± 160 ¹⁴ C BP (Pta-1105)	Regression	Vogel and Visser 1981
Pollen	Cederberg Mountains: increasing fynbos, thicket and succulent vegetation	13000 ± 130 ¹⁴ C BP (Pta-5896) to 11390 ± 100 ¹⁴ C BP (Pta-6041)	Increasing temperatures and reduced precipitation	Scott and Woodborne 2007a, 2007b
Pollen	Eksteenfontein spring: <i>Stoebe/Elyttopappus</i> indicate cool temperatures and increase of Karoo-like environment	15.2 to 13.6 cal BP (extrapolated dates)	Cool and humid replaced by aridity	Scott et al. 1995

Table 3. Species list of identified fauna from the MIS 3 (52–51 kyr BP) and MIS 2 (23 cal kyr BP) layers at Spitzkloof A. NISP is number of identified specimens and MNI is minimum number of individuals.

Species		52–51 kyr BP		23 cal kyr BP	
		NISP	MNI	NISP	MNI
Black-backed jackal	<i>Canis mesomelas</i>	2	1	2	1
Carnivore size 1		1	/	1	/
Cape Hare	<i>Lepus capensis</i>	1	1	2	1
Namaqua molerat	<i>Bathyergus janetta</i>	2	1		
Rock hyrax	<i>Procavia capensis</i>	1	1	1	1
Steenbok	<i>Raphicerus</i> <i>campestris</i>	2	1		
Klipspringer	<i>Oreotragus</i> <i>oreotragus</i>			1	1
Bovid size class 1		11	1	5	1
Duiker	<i>Sylvicapra grimmia</i>	2	1		
Springbok	<i>Antidorcas</i> <i>marsupialis</i>				
Bovid size class 2		21	1	56	3
Gemsbok	<i>Oryx gazella</i>	2	1	14	3
Red hartebeest	<i>Alcelaphus</i> <i>buselaphus</i>			1	1
Bovid size class 3		2	/	61	1
Equid sp. zebra				3	1
Mammal size class 1		287	/	349	2
Mammal size class 2		175	1	199	/
Mammal size class 3		10	/	121	/
Mammal size class 4		1	1	37	1
Brant's whistling rat	<i>Otomys brantsii</i>			3	1
<i>Mus</i> sp.				1	1
Micromammal		51	2	179	1
Mammal unidentified size class		3,123	/	4,555	/
Namaqualand speckled padloper	<i>Homopus signatus</i> <i>signatus</i>			31	3
Namaqua tent tortoise	<i>Psammobates</i> <i>tentorius trimeni</i>	24	3	70	4
Angulate tortoise	<i>Chersina angulata</i>	95	3	873	14
Tortoise		792	3	5,912	6
Unidentifiable fragments mammal or tortoise		3,029	/	1,346	/
Aves size 1		3	1		
Aves size 2		1	1	20	2

(Continued on next page)

Table 3. Species list of identified fauna from the MIS 3 (52–51 kyr BP) and MIS 2 (23 cal kyr BP) layers at Spitzkloof A. NISP is number of identified specimens and MNI is minimum number of individuals. (Continued)

Species	52–51 kyr BP		23 cal kyr BP	
	NISP	MNI	NISP	MNI
Large snake	1	1	1	1
Medium snake			4	1
Small snake	2	1	4	1
Snake	4	/	2	/
Small fish			1	1
Land snails	4	2		
Black mussel			2	1
Total	7,649	28	13,857	54
Diversity of species	16		19	
Large ungulate index	16%			48%
Small mammal MNI × KJ	800,000	35%	900,000	14%
Large mammal MNI × KJ	1,451,400	64%	5,250,000	85%
Tortoise MNI × KJ	18,000	1%	54,000	1%

Size classes of mammals are based on Brain 1981 such that size 1 <23 kg, size 2 23–84 kg, size 3 85–295 kg, size 4 296–900 kg, size 5 >900 kg. Large ungulate index is calculated as $(\sum \text{NISP medium} + \text{large ungulates} / \sum \text{NISP small} + \text{medium} + \text{large ungulates}) * 100\%$

While no clear ostrich eggshell flask mouths were recovered at Spitzkloof, we did retrieve 283.1 g of ostrich eggshell fragments likely representing a minimum of two eggs (average weight of an empty eggshell is 259 g; Dewar, 2008). There is no evidence that people were accessing the resources offered by riverine environments and it is therefore likely that the tributary outside the shelter was not in flow. While palaeoenvironmental proxies indicate that MIS 3 was overall cooler and wetter than today (Dewar and Stewart 2016), this period was also one of great climatic flux (Table 2; Stewart et al. 2016). While the presence of a zebra-sized ungulate suggests that fodder was available and potentially even grass, the identified species are all arid-adapted. There is thus little support for a particularly wet environment, and conditions may have been not dissimilar to today, if slightly more humid and unstable. There are no sewing tools in the assemblage, but there are fur-bearing species,

a bone bead, and two ostrich eggshell bead preforms that could have been used for making clothing or personal ornamentation (Dewar and Stewart 2012). There is no evidence for personal ornamentation or bone tools at Apollo 11 from the MIS 3 layers, but there are fur-bearing mammals and ostrich eggshell (Murray-Wallace et al. 2015).

Thus far the environmental context is inconclusive, but the large ungulate at Spitzkloof and zebra at Apollo 11 may suggest a slightly cooler and wetter period than today. While people seemingly reused the site from 52 to 51 ka BP (Dewar and Stewart 2012), it was likely visited by small groups of highly mobile people pursuing an opportunistic, broad subsistence strategy. Terminal MIS 3 was a period of particularly pronounced instability (Table 2), which may explain the apparent occupational hiatus between 51 ka and 23 ka cal BP.

Evaluating the 23 ka cal BP occupation at Spitzkloof A, important differences

are apparent in the intensity of site use and in the subsistence and settlement strategies that people pursued there. The diversity of species increases ($n = 19$) and the total NISP is nearly double that of MIS 3 (Table 3). We now see more large ungulates, including zebra, but also red hartebeest (*Alcelaphus buselaphus*) and gemsbok, both large grazers. We also see evidence for contact with the coast, which would have been well over 60 km distant (Dewar and Stewart 2016), in the presence of two black mussel (*Choromytilus meridionalis*) shells. A single fish vertebra indicates access to riverine environments, although the lack of other freshwater species and the absence of other remains suggest that the fish did not derive from the tributary immediately in front of the site. Based on NISP it would seem that tortoises were the most important contributions to the diet at 78% of the faunal assemblage, followed by small mammals at 17% and large ungulates at 5%. Evaluating the proportion of large to small animals, the large ungulate index reveals a higher contribution to the diet from the larger animals at 48% of all ungulates. This indicates that people practiced a broad diet with a fairly even contribution of small and large ungulates. However, calculating the available kilojoules based on MNI (Table 3), the large ungulates provided 85% of the total energy available, while the small mammals and bovids contributed 14% and the tortoises <1%. Clearly, the large ungulates contributed much more to the diet than the tortoises. There are also more rocky loving species in this assemblage with the addition of klipspringer (*Oreotragus oreotragus*), and the Namaqualand speckled padloper (*Homopus signatus signatus*, a tortoise) in addition to the rock hyrax, a pattern more similar to Apollo 11. While the remaining prey are plains species and are available in the immediate vicinity of the site, especially if grasses were abundant, these rocky loving species suggest that people were also ranging further afield while living at Spitzkloof A, perhaps into the Kamiesberg Mountains to the northeast, beyond which flows the Orange River. There is also evidence of a shift in hunting strategy, with a drop in the number of animals that are more easily

collected, and an increase in those large ungulates that typically require active hunting and tracking. The faunal material from the MIS 2 layers (early LSA) at Apollo 11 suggest a similar strategy. While based on NISP the diet is less reliant on tortoises (3%) and more focused on small mammals (80%), the majority of calories overall are still coming from the large ungulate with zebra, representing 16% of the total assemblage (Vogelsang et al. 2010).

At Spitzkloof, the 23 ka cal BP strata yielded one identified ostrich eggshell flask mouth and 1179 g of eggshell fragments, representing five ostrich eggshells. There is also more evidence for social interactions, with ochre appearing for the first time, along with a bone bead, two large ostrich eggshell bead preforms, and two complete beads. Two engraved ostrich eggshell flask fragments (single wavy lines) reinforce the evidence for enhanced social signaling. The substantial volume of sediment deposited during this time period suggests either a larger group of people used the site more frequently or for much longer periods of time. At Apollo 11 we also see an increase in social artifacts as Wendt (1976:7) refers to the presence of ostrich eggshell and bone beads as well as fragments of ostrich eggshell containers, some bone tools, fragments of seashells, pigments, and minerals in the early LSA layer D.

The 23 ka cal BP assemblage represents a subsistence strategy that suggests an opportunistic and broad diet (tortoise, small mammals, birds, fish, and shellfish). Yet people were often also hunting the highest ranked or largest species, including zebra, red hartebeest, and gemsbok. This strategy suggests a highly mobile group taking advantage of whatever they come across as they focused on hunting large grazing animals, a pattern mirrored at Apollo 11. The palaeoenvironmental proxy data for this period (Table 2; Chase and Meadows 2007) indicate that it was one of the coldest in human prehistory. Decreased temperatures would have increased the effectiveness of rainfall by reducing overall evapotranspiration (Dewar and Stewart 2016). This seems to have produced favorable environmental conditions for supporting a range of large grazers. Peo-

ple were extracting resources from riverine, inland, and coastal landscapes during what were possibly seasonal rounds. However, evidence for high levels of mobility notwithstanding, some aspects of the behavioral pattern for this time period are slightly suggestive of an adaptation to a more predictable environment. Mobility and diet indicators suggest an unpredictable environment—people were highly mobile and overall practiced a generalist diet, but they were also narrowing their diet by focusing on highly ranked (large) ungulates that require an increase in travel over processing time. Though speculative, it is possible that they were also social signaling through their use of pigments and decorated ostrich eggshells in order to delineate territory, something perhaps reflected in their more recurrent use of the Spitzkloof A site.

CONCLUSIONS

At the outset of this article we asked: (1) what was the tempo, nature, and causes of the Namaqualand coastal desert; (2) what was the environment like; and (3) what pre-existing socio-technological strategies or new innovations did people use to adapt to this desert environment? The transition from pioneer to colonizer in this unpredictable environment occurred multiple times as the environment ameliorated from overwhelming dry heat or intense cold. We have seen that the region was colonized and then abandoned often, and sometimes for many thousands of years, as shown at Spitzkloof A, Apollo 11 and again—from the evidence of multiple sites—during the Holocene (Dewar 2008). Pleistocene peoples would therefore have had to relearn the landscape and its resources multiple times before becoming relatively “adept” Namaqualand foragers, and once the region’s archaeological record is better resolved these recurrent signatures should be detectable.

Humans were certainly, if very sporadically, using Namaqualand prior to the MSA, as shown by rare handaxes and Victoria West cores. But the earliest colonizations in the region—occupations that resulted in pro-

longed presence (centuries or millennia?)—probably occurred during the MSA. We have evidence for continuous re-occupation of Spitzkloof A from early/mid MIS 3 (52 to 51 ka BP). In southern Namaqualand, two recently described undated sites—Soutfontein 1 and VR003—contain industries with tool forms diagnostic of the Still Bay (~70 ka) and Howiesons Poort (~65–60 ka), respectively (Mackay et al. 2010; Steele et al. 2012). These assemblages at both sites are large, and VR003 possesses a deep sequence that likely predates the Still Bay (Steele et al. 2012). Thus, it seems that Namaqualand’s southernmost extreme was colonized by MIS 4 and probably earlier, which is consistent with its close proximity to the better watered Cape regions where population levels were presumably more stable. In northern Namaqualand, Still Bay and Howiesons Poort tools have only been recovered as isolated finds. While this might be marshaled to support a pioneer interpretation for these artifacts, it is important to note that Apollo 11 contains deposits with both Still Bay-like and Howiesons Poort artifacts in high densities, as well as two deeper “Early MSA” industries dated to $180,000 \pm 10,000$ years and $236,000 \pm 18,000$ years (Murray-Wallace et al. 2015). It is far more likely, therefore, that northern Namaqualand, situated between the Cape and Namibia, was colonized much earlier in the MSA, underscoring the importance of dating Spitzkloof A’s deepest layers.

While awaiting better palaeoenvironmental proxy data, we have turned to Namaqualand’s better known Holocene archaeological record to make predictions about whether and which particular environmental conditions corresponded to Pleistocene human dispersals into the region. The most intensive Holocene occupations took place during the Neoglacial and LIA—both stadial phases with reduced temperatures and greater humidity—with little to no demonstrable human occupation at other times. The occupations at Spitzkloof A largely meet our expectations of the site having been used when the region was wetter and colder than today. The presence of large ungulates during both Pleistocene oc-

cupation pulses examined here (52–51 ka BP and 23 ka cal BP) indicates higher levels of humidity than prevail at present. This pattern of human incursions during glacial or stadial phases is also consistent with the above-mentioned human presence in the broader region during MIS 4, which seems to have been a period of widespread humidity across southern Africa (Chase 2010). Looking further back in time, it might also hold implications for understanding the timing and routes of the earliest colonizations, as perhaps captured in the deepest, as yet undated levels of VR003 and the MIS 6 and early MIS 7 dates from Apollo 11. Humans dispersing into new landscapes tend to follow conspicuous landscape features, including coastlines, mountains, and rivers (Kelly 2003; Meltzer 2009; Veth 1989). Evidence for coastal dispersals from the Cape northwards or Namibia southwards during glacial/stadial phases of lowered sea levels will have been eradicated by subsequent regressions. If humans opted to travel along the Cape Fold Belt and then—from Namaqualand onwards—the Great Escarpment, this evidence should be preserved at sites similar to Spitzkloof in the mountains' front ranges. A third potential route is the Orange River, which is oriented east-west rather than south-north, draining the subcontinent's semi-arid interior after rising in the high rainfall Lesotho Highlands. We suspect that this may have been an important dispersal corridor into the region, not least because it crosses both southern Africa's summer and winter rainfall zones, precipitation in which appears to have been out of phase during the Pleistocene not only seasonally but also over long-term (glacial/interglacial) climatic cycles (Chase and Meadows 2007). We stress, however, that these routes need not be seen as mutually exclusive.

Finally, testing our predictions of subsistence and settlement revealed many similarities between Holocene and Pleistocene occupations. But more interestingly, it also highlighted important differences that can be investigated further. For example, while relatively broad-spectrum diets appear to have characterized both Holocene and Pleistocene groups, there is no evidence the

latter engaged in mass harvesting of situational or seasonal bonanzas. If such episodes can be related to broader pan-southern African trends of Holocene subsistence intensification (Mitchell 2002), this may suggest that Pleistocene population densities were considerably lower. This is interesting with regards to the subsistence signatures we obtained from the 52–51 ka BP and 23 ka cal BP occupations, which suggest broad, arid-adapted diets, but with regular access to high-ranked foods like large ungulates. It would seem that access to these calorific resources during Pleistocene occupational pulses, together with the evidence for greater overall environmental productivity (particularly in MIS 2), would have promoted larger absolute population sizes than during the Neoglacial or LIA. One possibility is that limitations to the growth of Pleistocene populations, whether resident in Namaqualand or situated nearby, were underwritten by rapid climatic changes even during phases that promoted greater access to challenging environments. While this could have theoretically inhibited the rate of in situ socio-technological innovations or their successful transmission (Powell et al. 2009), local foragers may have maintained large enough effective population sizes for innovative technologies and strategies to develop by maintaining social connections to groups outside the region (Mackay et al. 2014). The most significant such innovation may have been the unassuming ostrich eggshell flask (Texier et al. 2010). Testing this and other hypotheses raised in this paper will require many more data points across this vast region. In the meantime, we hope to have shown that in marginal environments with sporadic histories of occupation like Namaqualand, the archaeology of recent foragers can help us forage for food for thought about the region's deep past.

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