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Geoarchaeological investigations at Diepkloof Rock Shelter, Western Cape, South Africa

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ABSTRACT

The sedimentary sequence at Diepkloof Rock Shelter formed through a complex interaction of depositional and post-depositional processes and was variously influenced by biogenic, geogenic, and anthropogenic agents. Here, we present the results of a micromorphological study of the sediments at Diepkloof, focusing in particular on the numerous anthropogenic inputs and modifications recorded within the sequence. By applying the microfacies concept, we were able to identify hearth burning and maintenance, bedding construction and burning, and surface modification by trampling as major processes that contributed to the formation of the site. The human activities recorded within the sediments show a marked change throughout the sequence, implying a shift in the use of the site over time. The present study also provides a context for evaluating other classes of artifacts and data collected from the site.

1. Introduction

Excavations at Diepkloof Rock Shelter (DRS) have yielded a long, cultural sequence spanning MIS 5–3 and including pre-Still Bay, Still Bay (SB), Howiesons Poort (HP), post-HP and Later Stone Age (LSA) occupations (Table 1) (Parkington et al., 2013; Porraz et al., 2013; Tribolo et al., 2013). Such a complete sequence is unusual in South Africa. Therefore, DRS provides a rare opportunity to investigate the cultural evolution of modern humans living along the western coast of southern Africa during the Middle Stone Age (MSA). The archaeological record of DRS, as with any archaeological site, does not consist solely of chipped stone, ochre, eggshell containers, and floral and faunal remains. Rather, these materials are embedded within a sedimentary matrix that provides the ultimate context for the interpretation of the site (Goldberg and Berna, 2010). The present geoarchaeological study investigates the site formation processes at DRS, emphasizing the roles that various depositional and post-depositional agents have played in forming this important archaeological sequence.

Geoarchaeological research at DRS has focused on two main issues in the interpretation of the sequence and site. First, we wished to investigate the integrity of the various layers and contexts, testing hypotheses developed from the analysis of various classes of artifacts. Specifically, our investigation addresses the following questions about the sequence: do we see major depositional hiatuses in the sequence? Do transitions between various technocomplexes reflect longer-term periods of cultural change, or do they represent abrupt changes that have been masked by later post-depositional processes, such as bioturbation? And, are precocious technological and symbolic artifacts located within stratigraphically secure contexts?

Secondly, we wished to identify the various geogenic, biogenic, and anthropogenic processes that led to the formation of the DRS sequence and understand how these processes changed over time. Through the use of micromorphology, geoarchaeologists are able to isolate different agents and processes that form a site, making it possible to identify human actions that helped to create the geoarchaeological record (Courty et al., 1989). Thus, with the appropriate analytical tools, geoarchaeologists treat deposits as proper artifacts (Goldberg and Bar-Yosef, 1998; Goldberg and Berna, 2010; Miller, 2011), and by identifying the various human activities that

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Table 1
List of Stratigraphic Units (SUs) present in the Main Sector profile (K 6/7–M 6/7) and sampled for micromorphological analysis. Corresponding Lithostratigraphic Units (LUs) and Technocultural subdivisions (Porraz et al., 2013) are also given. The reported Luminescence ages are averages of dates obtained from multiple samples from the same SUs, as detailed in Table 3 of Tribolo et al. (2013). Note that the averaged date for the Late HP, indicated in parentheses, was obtained from SUs OB2–4 in the "Back Sector" (Fig. 2), as described in Tribolo et al. (2013).

Stratigraphic Units	Lithostratigraphic Units	Technocultural Units	Radiometric ages
Claude	1	post-HP	
Denzel			
Danny			
Debbie		Late HP	
Dean			
Darryl			
Deon			
Eric			
Ester			(52 ± 5 ka)
Edgar			
Eve			
Frans			
Fred		Intermediate HP	83 ± 8 ka
Frank			
Fannie			
Fox			85 ± 9 ka
Fiona			
Governor			
John	2		77 ± 8 ka
Jeff			
Joy	3		
Jack		MSA-Jack	89 ± 9 ka
Jude			
Jess		Early HP	109 ± 10 ka
Julia			
Kate			105 ± 10 ka
Kerry			
Kenny			
Kegan			
Keeno		SB	
Kim			109 ± 10 ka
Larry			
Logan			
Leo			
Lynn		Pre-SB Lynn	100 ± 10 ka
Lauren		MSA-Mike	
Mike			
Mark		Lower MSA	107 ± 11 ka
Moses			
Maggie			
Miles			
Mary	4		
Noel			100 ± 10 ka
Noah			
Nina			
Nel			

contributed to the accumulation of deposits at DRS, we are able to construct interpretations of past human behavior. Specifically, we wished to address the following questions: what past human activities contributed to the formation of the sequence? How do these activities vary diachronically? And, does the diachronic variation in past human activities reflect changes in the settlement dynamics of the MSA inhabitants of DRS?

1.1. The site and its geographical and geological setting

DRS, along with the nearby shelter of Diepkloof Kraal, forms a complex of sites ("Diepkloof") located ca. 180 km north of Cape Town within a remnant butte, or *koppie*, of bedded, quartzitic sandstone of the Table Mountain Group (TMG). The sites sit ca. 100 m above the southern shore of the Verlorenvlei River, which meets the Atlantic Ocean at Elandsbaai, approximately 14 km northwest of Diepkloof (Parkington et al., 2013). The Ordovician TMG dominates the bedrock geology around Diepkloof, and consists of bedded sandstones, siltstones, shales, and conglomerates that have undergone low-grade metamorphism. Differential erosion of the relatively horizontal-lying beds of the TMG at Diepkloof is responsible for the formation of both DRS and Diepkloof Kraal. The erosion of weaker, underlying beds, particularly a shaley member found at the back of the shelter (Dayet et al., 2013), created instability in the more resistant, overlying quartzitic beds at the *koppie*, leading to extensive collapse and the formation of an overhang. The sizes of rocks that have fallen from the walls and roof of the shelter vary from tens of cms to several ms in diameter. A large boulder of rockfall (about 13 m across) at the entrance to DRS (Fig. 1) is likely responsible for the thick accumulation of sedimentary deposits within the shelter, since it formed a semi-enclosed space that protected the site from erosive processes.

The ca. 200 m^2 of space within the shelter is largely filled with sediments of variable thickness that accumulated behind this boulder. Lenoble and Martineau (2003) used a penetrometer survey to estimate that the thickest accumulations were within the K6–L6 sector, which is located toward the entrance of the shelter (Parkington et al., 2013). A deep sounding within these squares has uncovered a ca. 3.1 m thick sequence. It is not clear if the current base of excavation, which ended on top of an accumulation of quartzite blocks, is close to bedrock, or if the deposits continue significantly below (see Parkington et al., 2013, for a detailed discussion of the excavation grid and history of research). Although field observations from different parts of the excavation trench have been included in the geoarchaeological study, the results and interpretations presented here are based largely on samples and observations collected from the K6–M6 sector, which forms part of the Main Sector (M5–M9/N5–N9) used in other analyses (Texier et al., 2013) (Fig. 2).

1.2. Micromorphology and microfacies analysis

In this study we apply the method of micromorphology, coupled with detailed field observations and Fourier Transform infrared (FTIR) spectroscopy of loose sediment samples. Micromorphology is the study of intact blocks of sediment that have been indurated with a polyester resin, sliced, and made into petrographic thin sections. The power of this method lies not just in its ability to identify the sedimentary components of an archaeological deposit, but in its ability to identify the spatial relationship of sedimentary components, microfabrics, and post-depositional features. Therefore, micromorphology is ideal for the study of sites such as DRS, where a complex interaction between geogenic, biogenic, and anthropogenic processes has led to the formation of the archaeological record.

Within the Main Sector at DRS, more than 50 stratigraphic units (SUs) have been identified. Most of these SUs do not represent a single depositional event, but rather are complexes of discontinuous lenses and beds that form identifiable stratigraphic entities that can be traced across the area of excavation. If we were to count every lens, bed or lamination visible within the DRS sequence—each of which represents a single, depositional event—we would number them in the hundreds, if not thousands. Therefore, it is not practical, or productive, to describe each and every depositional event individually. Rather, we have chosen to use the concept of microfacies (Courty, 2001; Flügel, 2004; Goldberg et al., 2009) to identify key types of deposits that occur repeatedly throughout the sequence. At DRS, the individual depositional units – in the form of discontinuous beds, lenses and laminations – are referred to as microfacies units (MF units). These units in turn are classified into microfacies types (MF types). Multiple MF units form single stratigraphic units (SUs), which were identified in the field and form the main units of analysis for