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News and views

Provenancing silcrete in the Cape coastal zone: Implications for Middle Stone Age research in South Africa

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Introduction

Silcrete is a term first used by Lamplugh (1902) to describe a highly resistant and well-cemented near-surface crust formed as a result of silica accumulating within and cementing a pre-existing soil, sediment, rock or weathered material (Nash and Ullyott, 2007). It is widespread in southern Africa, with some of the most extensive outcrops occurring around the Cape coast of South Africa (Fig. 1; Summerfield, 1983a; Roberts, 2003). In this region, silcretes demarcate ancient marine-planed surfaces, alluvial plains and river terraces (Roberts, 2003) (Fig. 2A), and display a range of features indicative of the role of pedogenic- and/or groundwater-related processes in their formation (Fig. 2B–D). The majority of outcrops are at a considerable elevation relative to present-day sea level.

Silcrete is also a major archaeological raw material in the South African Stone Age. Due to its knapping properties (e.g., Brown et al., 2009; Villa et al., 2009b), it has been used to make a variety of tool types, and is one of the most widely utilized materials for artifact manufacture in the southwestern and southern Cape (Roberts, 2003). Silcrete is prevalent in lithic assemblages from the Middle Stone Age (MSA) (Table 1), particularly in those with Still Bay or Howiesons Poort components. Silcrete artifacts have been used to infer a range of behavioral traits during the MSA, including local versus long-distance acquisition, increased mobility, exchange networks, technological complexity, knapping strategies, intentional heat treatment, stylistic change and even symbolic behavior (see Table 1). However, all of these inferences hinge upon first establishing the provenance of the silcrete raw material, whether as an indication of the distance of transport by early humans or as an initial step in the selection of materials for experimental replication studies.

The potential for using silcrete in provenancing studies in South Africa has been hinted at over the last decade. Roberts (2003: 1), for example, suggests that "since the character of silcrete [in the Cape] varies geographically and since its occurrence is frequently localized" it might be used to infer Stone Age migration patterns. Ambrose (2006: 367), referring to geochemical data within Roberts' memoir, states that regional differences in the bulk chemistry of Cape silcretes are "large enough to suggest that trace element and isotopic methods could be used to clearly differentiate sources." However, in a more recent review, Ambrose (again citing Roberts, 2003) suggests that "chemical compositions of raw materials such as silcretes are similar over great distances" (Ambrose, 2012: 57).

Recent work by Nash et al. (2013) indicates that both Roberts (2003) and Ambrose (2006) may have been correct. Silcretes in northern Botswana and Namibia have been shown to exhibit spatial differences in major and trace element geochemistry, controlled by subtle variations in the mineralogy of the Kalahari Group sediments within which they formed. These differences have been used to identify the transport of silcrete raw materials by early humans over distances of 220–295 km to Tsodilo Hills in northwest Botswana during the MSA.

Given the wide variety of bedrock and sediment types within which Cape coastal silcretes are developed (Roberts, 2003), it would be expected that Cape silcretes would exhibit equivalent, if not more clearly discernible, chemical differences to those identified in the Kalahari. This article explores whether this is the case, through an analysis of the geochemistry of silcretes from selected sites across the Cape. We demonstrate that silcretes developed in association with different bedrock types do indeed have distinct chemical signatures and could therefore be used in provenancing

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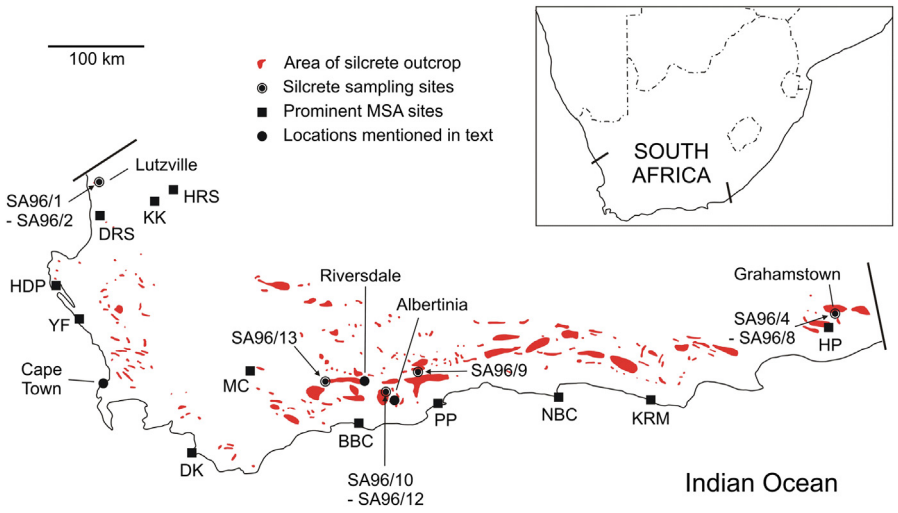

Figure 1. Distribution of silcrete in the Cape coastal zone (after Roberts, 2003; Minichillo, 2006; Will et al., 2013), together with the locations of silcrete sampling sites and the prominent Middle Stone Age sites listed in Table 1. Blombos Cave (BBC), Die Kelders 1 (DK), Diepkloof (DRS), Hoedjiespunt 1 (HDP), Hollow Rock Shelter (HRS), Howiesons Poort (HP), Klasies River – Main Site (KRM), Klein Kliphuis (KK), Montagu Cave (MC), Nelson Bay Cave (NBC), Pinnacle Point (PP), and Ysterfontein (YF).

studies. We conclude with a consideration of the implications of our results for MSA archaeology in South Africa.

Materials and methods

As a first stage in our investigation, silcrete profiles from across the Cape coastal zone were described and sampled (Fig. 1). The goals of the sampling strategy were to collect representative materials from well-documented areas of outcrop and to sample silcretes developed in association with a range of rock types. Sampling was not intended to provide a comprehensive inventory of all areas of exposure; this is a goal for future research. Initial sampling sites were targeted from a review of previous studies (notably Frankel and Kent, 1938; Bosazza, 1939; Mountain, 1946; Frankel, 1952; Summerfield, 1978, 1981, 1983b, 1983c; 1984) with further localities identified during the course of fieldwork. Details of the 12 sampling sites are given in Table 2, with locations indicated in Fig. 1. The majority of the sampling sites were in contemporary quarries or road cuttings. This allowed access to full silcrete profiles, including any underlying exposed weathered bedrock. At each site, the outcrop was surveyed and logged, with samples taken at regular vertical intervals from a representative profile. Normally at least three samples were taken from each outcrop to ensure that any within-profile variability was incorporated into subsequent geochemical analyses. An exception was the Lutzville area where thick exposures of silcrete are rare. Where exposed, a sample of the

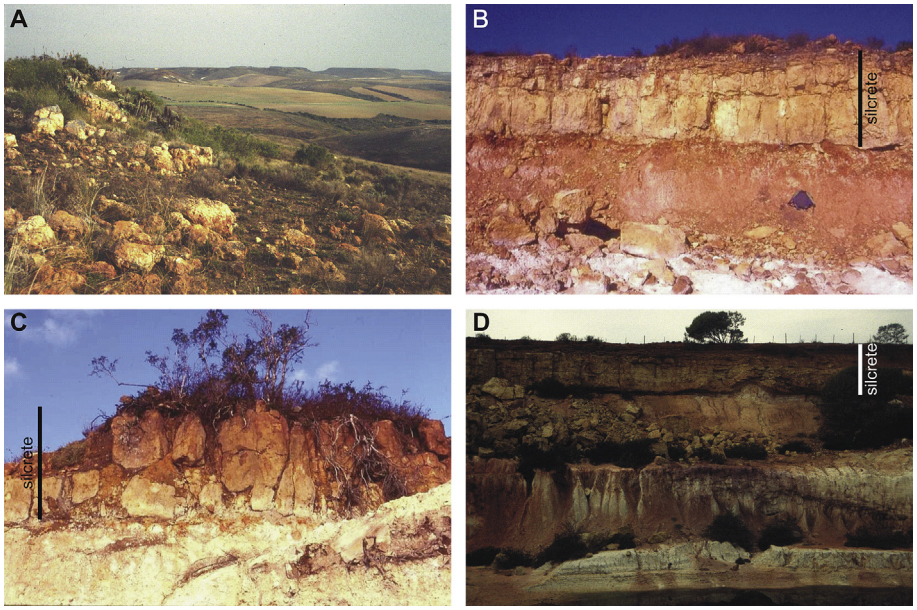

Figure 2. Silcrete in the Cape coastal zone. (A) Natural silcrete outcrop near Albertinia, with a silcrete-capped ancient land surface visible in the background; (B) quarry face, revealing deeply weathered Dwyka Group bedrock (base), passing upwards into an iron-rich weathered zone and capped by a 2.25 m thick pedogenic silcrete (profile SA96/4, east of Grahamstown); (C) uppermost part of a quarry face showing deeply weathered Dwyka Group bedrock overlain by a 2.30 m thick pedogenic silcrete horizon showing distinctive columnar structures (profile SA96/5, Enniskillen Farm, north of Grahamstown); (D) quarry face, revealing c. 13 m of deeply weathered Bokkeveld Group sediments capped by a massive 4.00 m silcrete, which preserves original sedimentary structures (profile SA96/11, Rooikop, north of Albertinia). Full details of profile locations are given in Table 2.