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Multi-proxy survey of open-air surface scatters in drylands: Archaeological and physico-chemical characterisation of fossilised dunes in North Gujarat (India)

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ABSTRACT

This research aims at improving our understanding of open-air archaeological surface scatters in drylands, their extension and the intensity of human activities during their occupation. To do so, the study of physico-chemical proxies is integrated to that of archaeological artefacts by means of systematic field survey combined with laboratory sedimentary analyses and a robust statistical approach. In most dry regions, archaeological survey has traditionally aimed at the collection of artefacts. When present, the study of physical and geochemical samples has been limited to excavated archaeological levels. In this work, we evaluate the archaeological significance of physico-chemical proxies from surface samples collected within and around four mid and late-Holocene surface scatters in North Gujarat, a semi-arid region located at the south-west margin of the Thar Desert in India. The four archaeological scatters are found on top of fossilised sand dunes. Archaeologically, they represent subsistence strategies based on hunting and gathering, agro-pastoralism, or a succession/mixture of the two. The four locations were systematically sampled across a linear transect. For each sampling unit, the archaeological materials were quantified and classified by means of a Linear Discriminant Analyses. Physio-chemical variables were ordinated in a PCA space and clustered through a Hierarchical Clustering. Results were displayed along the dune transect and integrated into a Correspondence Analysis. Significant differences are attested in the spatial distribution and content of Ca, P and grain size, allowing us to suggest a set of distinct cultural soilscapes that characterise the dunes of the study area: vertisols (agric horizons in interdunal lower slopes), aridisols (relict dune surfaces in the mid-slope), and anthrosols (top dune). The last show a strong correspondence with the presence of archaeological artefacts, and the different intensity of human footprint are discussed accordingly to potential past subsistence strategies and the intensity of human occupation.

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1. Introduction

Surface scatters of archaeological materials are the most ubiquitous evidence of prehistoric human occupations with poor vegetation cover. These scatters, when recognised during field-walking, are often closely related to relict landscape features (e.g. dunes, water bodies and rock outcrops, see Tainter, 1979; Gallant, 1986; Wandsnider and Camilli, 1992; Fanning and Holdaway,

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2001; Fanning et al., 2007; Blau et al., 2008; Bayón et al., 2012). Such relationships are not always easy to establish in drylands, as they are prone to severe erosion and deflation processes from multiple agents (aeolian, alluvial and anthropic) that rework surface sediments (Goudie, 2002). In such cases, two major factors limit our capability to identify surface scatters and interpret past occupations: 1) the difficult identification of relict surfaces (e.g. as a consequence of flattening erosive processes); and 2) archaeological palimpsests are made of mixed archaeological materials, especially in contexts characterised by little sediment accumulation (Read, 1986; Brantingham et al., 2007).

Archaeological survey has traditionally aimed at the collection of artefacts to create preliminary typo-chronological seriations. While useful, this approach lacks a shared set of criteria for the systematic classification of surface evidence in different parts of the world (Kantner, 2008; Bevan et al., 2013). Moreover, the classification of surface scatters is hampered by the heterogeneous preservation of different archaeological materials. For instance, lithic and pottery are often the most abundant evidence even though the original assemblages included organic materials and other more perishable remains (Fernández-López de Pablo and Barton, 2015; Jennings et al., 2015). To overcome such limitations, new approaches based on the identification of alternative proxies have been used to improve the significance of archaeological surveys in drylands (Burger et al., 2002; Allen et al., 2008; Beach et al., 2008; Deo et al., 2011; Markofsky et al., 2016). Information embedded in soils and sediments, for instance, highlight the importance of physico-chemical descriptors as a proxy of long-term human activity and occupation (Mallol and Bertran, 2010; Wilson, 2013; Sedov and Jacobs, 2012; Salisbury et al., 2013; Kluiving et al., 2013; French et al., 2014).

Here we present an explorative geoarchaeological approach aimed at refining survey methods for the classification of surface scatters in drylands. The aims were: 1) to understand the spatial relationship between surface archaeological artefacts and physico-chemical signatures (of geogenic or anthropic origin) in relict landforms (fossilised sand dunes and interdunes) and 2) to explore whether different past subsistence strategies (hunter-gatherer, agro-pastoral, mixed) generated different and detectable physico-chemical signatures. The approach was tested with mid-Holocene and late-Holocene surface scatters on fossilised sand dunes and interdunes in North Gujarat, a semi-arid region located at the SE margin of the Thar Desert (India).

2. Background

North Gujarat is a semi-arid ecotone between the Thar Desert to NW and the Sabarmati River to the SE. This is one of the driest ecoregions in India and it is highly sensitive to the shifts of the Indian Summer Monsoon (ISM). The local seasonal rivers West Banas, Saraswati, Rupen and Khari cross the three main physiographic units of the area (Fig. 1): 1) the Aravalli Hills, 2) the Quaternary alluvial plains and 3) the *Little Rann* of Katchchh, a broad saline and marshy intertidal estuary. Fossilised sand dunes are

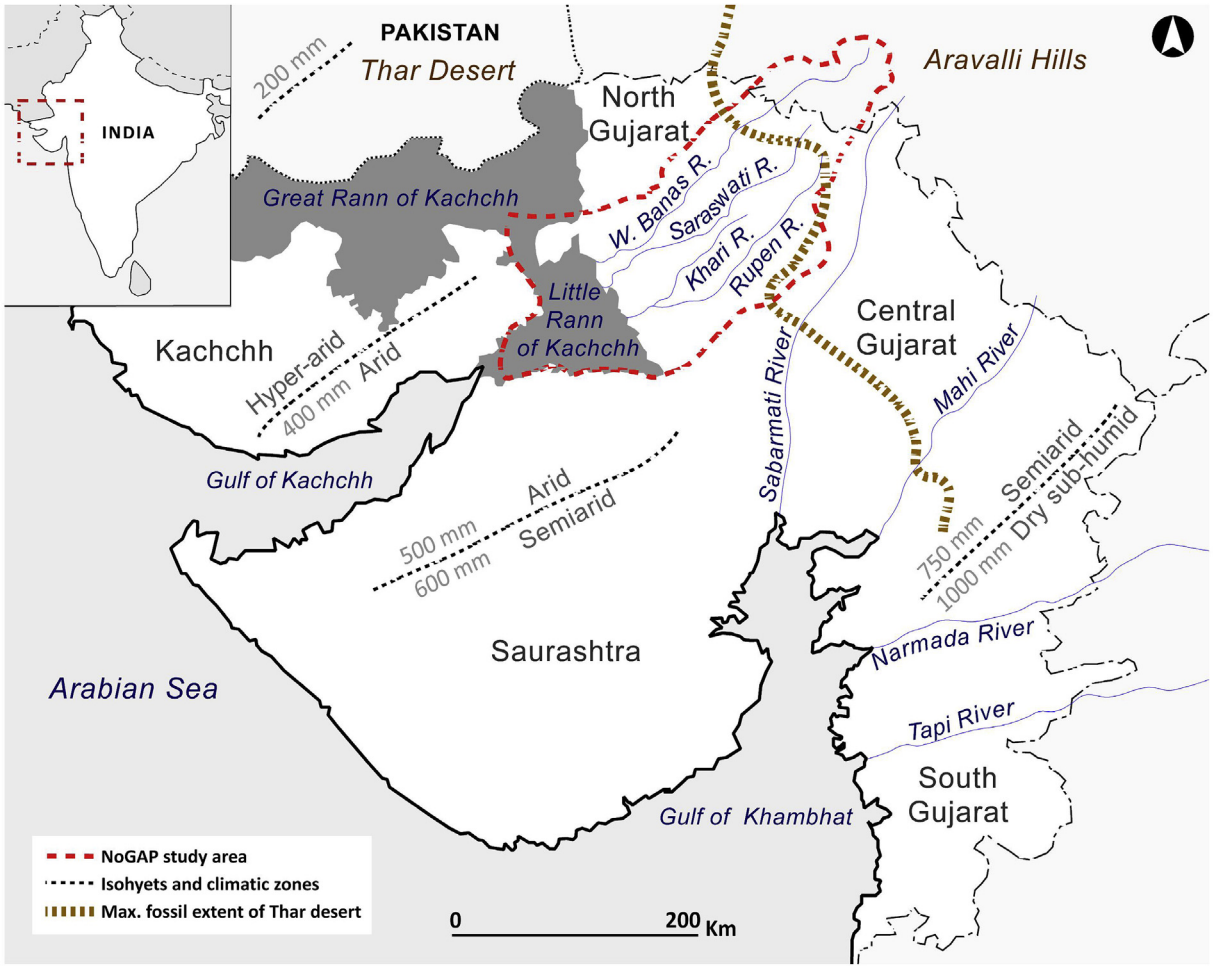

Fig. 1. Location map of the study area. Isohyet lines and climatic zones are from (Juyal et al., 2006), and the maximum fossil extent of Thar Desert is after Singhvi and Kar (2004).

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