Archaeological Research in Asia xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Archaeological Research in Asia

journal homepage: www.elsevier.com/locate/ara

Full length article

Prehistory and palaeoenvironments of the western Nefud Desert, Saudi Arabia

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ARTICLE INFO

Article history:
Received 13 October 2016
Received in revised form 8 February 2017
Accepted 14 February 2017
Available online xxxx

Keywords:
Palaeolakes
Nefud Desert
Saudi Arabia
Prehistory
Palaeontology
Palaeoenvironments

ABSTRACT

Mid-latitude dune fields offer significant records of human occupations in southwest Asia, reflecting human responses to past climate changes. Currently arid, but episodically wetter in the past, the Nefud desert of northern Saudi Arabia provides numerous examples of human-environment interactions and population movements in the desert belt. Here we describe results from interdisciplinary surveys in the western Nefud that targeted palaeolake deposits identified using satellite imagery. Surveys indicate the presence of thousands of discrete palaeolakes and palaeowetlands, providing valuable palaeoenvironmental records, and numerous archaeological and palaeontological assemblages. Geomorphological investigations suggest that many further deposits remain buried. Forty-six prehistoric archaeological sites have been identified in association with freshwater deposits, spanning the Lower Palaeolithic to the pre-Islamic Holocene. Lower Palaeolithic sites appear concentrated close to raw material sources near the Nefud fringe, despite the presence of freshwater and fauna deeper in the dune field. Middle Palaeolithic occupations extend more broadly, and by the early Holocene humans were at least periodically occupying areas deep in the desert. We present the first records of Neolithic sites in this dune field, including substantial hearth complexes distributed relatively deep within the dunes, potentially indicating increased mobility during this period. Later Holocene sites with stone structures are present around the dune fringes. Our results indicate that, during wet periods of the Pleistocene and Holocene, water in the western Nefud may have been more readily available than elsewhere in northern Arabia due to the high density of depressions where wetlands can form. The high frequency of lakes or marshes appears to have facilitated human occupations and dispersal through the region.

1. Introduction

The Nefud Desert is the northern-most of the major Arabian sand seas (Fig. 1A). Covering ~58,500 km^2 between latitudes 27°8′ and 29°45′, the Nefud is dominated by densely-packed dunes that can reach 80 m or more in height (Fig. 1B), a formidable barrier to overland movement. The Nefud is arid, receiving on average between 30 and 90 mm of rainfall a year (Edgell, 2006, pp. 144), although local flora is semi-arid in character (Schulz and Whitney, 1985) and rare heavy rainfall events can produce standing water that persists on playas for months.

Although currently semi to hyper-arid, palaeolake deposits in interdune depressions demonstrate that significant climatic changes during the past episodically resulted in the Nefud being considerably wetter than at present (Petraglia et al., 2011, 2012; Thomas et al., 1998; Schulz and Whitney, 1986; Garrard et al., 1981). Correlation of dates from these deposits with data from the wider Saharo-Arabian region initially suggested they related to wetter conditions during the Early Pleistocene (Thomas et al., 1998; Anton, 1984) and increased episodic moisture during the Late Pleistocene and Holocene (Schulz and Whitney, 1986; Hötzl et al., 1978). However, recent re-evaluations have indicated that Middle and Late Pleistocene humid phases were

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http://dx.doi.org/10.1016/j.ara.2017.02.002
2352-2267/

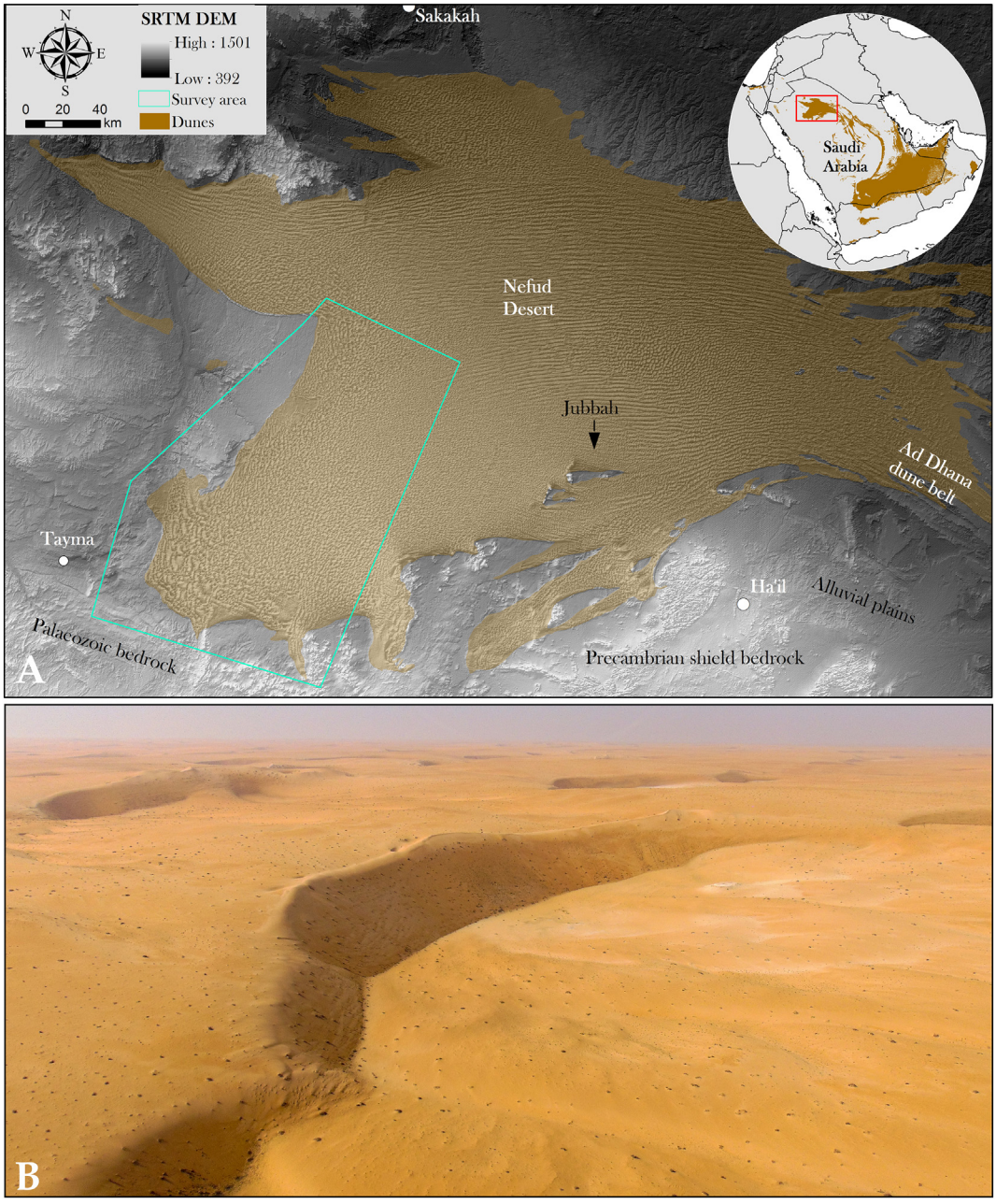

Fig. 1. The western Nefud desert in northern Saudi Arabia. A; Map showing the Nefud desert, study area, key locations and geomorphic features discussed in the text, and the extent of present dune cover. Inset shows the location of this map in relation to the wider Arabian Peninsula, with national borders and the extents of Arabian dune fields shown (Pollastro et al., 1999). B; Aerial photograph showing the present landscape of the western Nefud dune field.

responsible for most of the palaeolake deposits in this region (Rosenberg et al., 2013; Stimpson et al., 2015).

The nature, scale, dynamics, and timing of Pleistocene and early Holocene climatic changes are important in discussions of past human occupations of Arabia, as they could have provided ameliorated conditions facilitating population dispersals and survival in the currently arid desert regions (Parton et al., 2015; Drake et al., 2013; Parker, 2009). This is supported by archaeological assemblages identified across the Arabian Peninsula dating to these humid intervals (Groucutt et al., 2015a, 2015b; Petraglia et al., 2011, 2012, 2015; Groucutt and Petraglia, 2012; Armitage et al., 2011; Magee, 2014). Increased understanding of human-environment interactions in regions where extreme aridity alternated with humidity is a key objective for resolving debates concerning occupation in the middle latitudes. The Nefud, a sandy desert hosting numerous diachronic palaeoenvironmental archives, is an important region for evaluating such interactions.

The southern Nefud, particularly near Jubbah (Fig. 1A), has long been known to host archaeological assemblages associated with palaeolake deposits (Groucutt et al., 2015a; Hilbert et al., 2014; Shipton et al., 2014; Jennings et al., 2013; Petraglia et al., 2012; Groucutt and Petraglia, 2012; Garrard et al., 1981). However, until recently the archaeology of the western Nefud remained largely unknown. To address this gap, since 2013, the Palaeodeserts project, the Saudi Commission for Tourism and National Heritage (SCTH), King Saud University and the Saudi Geological Survey (SGS) have performed collaborative surveys of the western Nefud combining palaeoenvironmental, palaeontological, and archaeological studies. Our research focuses upon an area of around 12,000 km^2, extending

Please cite this article as: Breeze, P.S., et al., Prehistory and palaeoenvironments of the western Nefud Desert, Saudi Arabia, Archaeological Research in Asia (2017), http://dx.doi.org/10.1016/j.ara.2017.02.002