



Contents lists available at ScienceDirect

Quaternary International

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

An investigation of local scale human/landscape dynamics in the endorheic alluvial fan of the Murghab River, Turkmenistan

S. Markofsky ^{a, *}, A. Ninfo ^b, A. Balbo ^c, F.C. Conesa ^a, M. Madella ^a

^a Complexity and Socio-Ecological Dynamics (CaSEs) Research Group, Universitat Pompeu Fabra, Spain

^b Department of Geosciences, University of Padua, Italy

^c CEN Centre for Earth System Research and Sustainability, CLISEC Climate, Change and Security, University of Hamburg, Germany

ARTICLE INFO

Article history:

Available online xxx

ABSTRACT

Endorheic or inland deltas, commonly found across the deserts of Central Asia, represent unique and dynamic ecotones that are still not fully understood. These regions of environmental and landscape transition as well as social liminality straddle the line between fertile, sustainable environments and less productive desertic regions less capable of sustaining significant human occupation. Because such boundary areas are dynamic and often unpredictable, they are excellent case studies through which to study the complex processes that have characterized human/environmental relationships throughout the late Holocene.

This paper focuses on the local variability that characterizes these relationships in one such region, the terminal fan of the Murghab River in Turkmenistan. Populated since at least the late 5th millennium BP and likely earlier, the region has been variously described as an oasis environment in which desertic processes have been more or less stagnant throughout the late Holocene, or, alternatively, as a fertile, continuously occupied and heavily-cultivated alluvial fan in which desertification was a relatively late process, intensifying only in the mid 4th millennium BP. This paper presents geoarchaeological data from a series of test pits in the distal portion of the terminal fan to show that local-scale analysis indicates a far more complex interpretation, one shaped by the continuous and non-uniform interaction of aeolian and alluvial depositional environments, and one that bears substantially on human/landscape dynamics in the region. The late Holocene development of the distal fan is examined using proxy data from granulometric analysis, Loss on Ignition (LoI) and geochemical analysis, as well as a series of new OSL dates that refines the depositional chronology of the region. Ultimately, we show that landscape change throughout the Holocene has been characterized by pronounced variability at the local level not fully described by regional scale approaches. While differential aeolian encroachment, non-uniform alluvial processes, and climatic conditions bear significantly on the initial conditions for human occupation, human/environmental processes are ultimately co-evolutionary in nature.

© 2016 Elsevier Ltd and INQUA. All rights reserved.

1. Introduction

Arid-margin ecotones, transitional zones that straddle the line between fertile environments and less productive, often desertic regions, are increasingly recognized as excellent case studies through which to examine the complex socio-ecological processes by which humans and their surroundings mutually developed and changed (Barker and Gilbertson, 2000; Wilkinson et al., 2004; Cremaschi and Zerboni, 2010; Balbo et al., 2013). Often

characterized by locally dynamic environmental and ecological conditions, these regions highlight the inherent complexities of peopling such environments, and offer excellent opportunities to explore the co-evolutionary trajectories of societies and the landscapes in which they have existed.

As important case studies for examining marginal socio-ecological development at local scales, the endorheic or inland deltas of Central Asia offer excellent research potential. Such regions have come under increased scrutiny in recent years, yielding new insights into marginality (Cremaschi, 1998; Marcolongo and Mozzi, 1998; Cattani et al., 2008b; Mantellini et al., 2008; Ninfo, 2009, 2007; Boroffka and Hansen, 2010; Harris, 2010). In such regions, the dynamic transitional zones

* Corresponding author.

E-mail address: smarkofsky@hotmail.com (S. Markofsky).

between alluvium and desert yield unique socio-ecological trajectories that have specific implications for irrigation, groundwater management, crop productivity and the general use of resources (Cattani et al. 2008a,b; Rouse and Cerasetti, 2014; Spengler et al., 2014;). Particularly in distal regions of these alluvial fans, where transitions may be more immediate, small changes in local hydrology, geomorphology, land cover or land use can profoundly affect the socio-ecological balance at much larger scales, as can distant changes in hydrological or climatic regimes (e.g. changes in precipitation or glacial melt rate can have profound local effects on deltaic environments, often thousands of km away). It is therefore essential to develop a better understanding of these mechanisms not only to understand diachronic trajectories of human/environmental relationships but also to address the sustainability of such relationships.

This study addresses multi-scalar palaeohydrographic, geomorphological and sedimentological variability on the margin of the inland Murghab delta in Turkmenistan and investigates these dynamics as landscapes that would have been inhabited and potentially shaped by human populations during the mid to late Holocene. Interpretations of the terminal fan have ranged from models that envision the mid-late Holocene delta as an oasis environment within an extant desert landscape (e.g. Kohl, 1984; Hiebert, 1994) to others that present the delta as a fertile alluvial plain, heavily cultivated and settled (e.g. Cremaschi, 1998; Cattani and Salvatori, 2008; Ninfo, 2009, 2007). The research presented herein seeks to present, via a multi-proxy geoarchaeological approach, a more nuanced interpretation of the marginal distal portion of the alluvial fan and its implications for human occupation.

Through the integration of recently acquired test-pit data from a small yet archaeologically rich region of the distal margin in the context of broader palaeogeographic and palaeohydrological studies of the region, this study addresses three research goals:

- 1.) Assess local variability in the mid-late Holocene stratigraphic sequence as it relates to the potential for human occupation and resource exploitation
- 2.) Clarify the relationship between alluvial and aeolian processes at multiple analytical scales

- 3.) Situate local processes within the broader geomorphological and palaeohydrological context of the Murghab fan during the mid-late Holocene

1.1. Study area and research context

The endorheic alluvial fan of the Murghab River comprises part of a tilted fault block that lies within a vast geologic basin (Fig. 1). Dominated by the Karakum Desert, this basin subsides gradually westward from the Amu Darya river towards a posited low region north-east of the Kopet Dag mountains on the Turkmen-Iranian border (Marcolongo and Mozzi, 1998; Ninfo, 2009, 2007). The terminal fan has undergone constant change throughout the Holocene and the structure of the present-day delta represents only the latest chapter in a complex hydrological and anthropogenic history. The active alluvial fan of the present day lies several dozen kilometers west of the palaeodelta, a shift that has been attributed to the confluence of two factors. The first is the westward subsidence described above, although it should be noted that recent research indicates variability in the underlying geology; portions of the deltaic region itself may actually slope eastward within a broader westward declination of the basin itself (Ninfo, 2009). The second factor is the desiccation and regression of the delta channels (Lyapin, 1991; Marcolongo and Mozzi, 1998; Ninfo, 2009). This latter process has been attributed to water loss resulting from aridization and desertification in conjunction with water-management initiatives that intensified as a result of centralized administrative structures towards the middle of the third millennium BP (Lyapin, 1996; Cerasetti, 2006).

The presence of hundreds if not thousands of Bronze Age sites, ranging from small pottery scatters to mounded settlements comprising several hectares, attests to the widespread availability of water resources that were exploited at least as early as the last quarter of the 5th millennium BP (Fig. 2) (Cattani and Salvatori, 2008; Markofsky, 2013; Rouse and Cerasetti, 2016, this volume). Intensifying desertification in the 4th millennium BP, in conjunction with socio-political changes, may have played a role in dramatically altering the hydrological system (Cattani and Salvatori, 2008; Salvatori, 2008). Anthropogenic processes of water management have continued from prehistory to the present

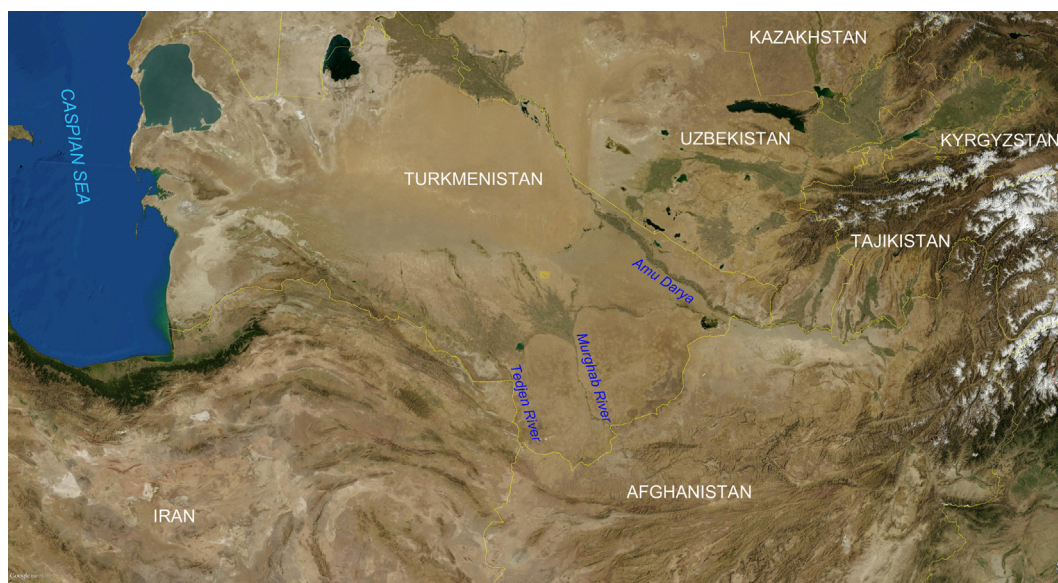


Fig. 1. Central Asia. Courtesy NASA Blue Marble imagery. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Download English Version:

<https://daneshyari.com/en/article/5113469>

Download Persian Version:

<https://daneshyari.com/article/5113469>

[Daneshyari.com](https://daneshyari.com)