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Micro-dynamics and macro-patterns: Exploring new archaeological data for the late Holocene human-water relationship in the Murghab alluvial fan, Turkmenistan

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ABSTRACT

In this article we re-visit hypotheses about the changing social and environmental landscapes in southern Central Asia during the late Holocene, specifically giving attention to the transitional period between the archaeologically-defined Late Bronze – Early Iron Age (second half of the 2nd millennium BC) and the numerous documented changes in the archaeological and physio-geographical record during this time. We focus on the northeastern Murghab alluvial fan (Turkmenistan) as a window into this complex period, and examine one aspect of human-environmental dynamics there, namely, the relationship between the location of archaeological sites and mapped ancient watercourses (palaeochannels) through time. Our analysis incorporates nearly 400 new archaeological sites documented in the north-eastern Murghab since 2006, which have not previously been included in published models of settlement and/or hydrological dynamics. Our findings suggest the periods of the Late Bronze Age and Early Iron Age (Yaz I) demonstrate two distinct access-to-water practices, which may correlate to different processes of socio-territorial control being implemented. While no single line of evidence can adequately disentangle the complex interconnected processes of environmental and social change, our results lend themselves to integration with the current working knowledge of the local processes of socio-environmental development in the Murghab. The results also fit more broadly within emerging discourse that recognizes the importance of micro-scale processes and adaptation in Eurasian prehistory.

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1. Introduction

Humans have long shaped the environments in which they live, demonstrated by studies detailing anthropogenic landcover change (deforestation and desertification), soil destabilization and salinization, and changing plant and animal communities (Ahmad et al., 2005; Alibekov and Alibekova, 2007; Fet and Atamuradov, 1994; Goison et al., 2012; Kamakhina, 1994; Kharin, 1994; Lioubimtseva et al., 2014; Miller, 1985; Nüsser and Dickoré, 2002; Pereladova et al., 1989; Pierce, 1960; Humphrey and Sneath, 1999). Yet in spite of recognizing the many ways humans have impacted large-scale environmental changes, there are relatively fewer studies that focus on the way human-environmental dynamics operating

at the local scale may have facilitated or reinforced broader regional changes (but see Spengler, 2014). This is an unfortunate situation, since it is the local scale which humans must necessarily operate in, interpret, and react to. We might better understand larger-scale processes as the result of cumulative human action at the local scale, where people often operate without knowledge of the changes they are provoking beyond their known world. Human-environment dynamics at local scales have the potential to compound unpredictably, precipitating broader systemic regional changes in both natural and social patterns. The desiccation of the Aral Sea over the last forty years (Lioubimtseva and Henebry, 2009; Cretaux et al., 2013; Lindsey, 2014) is a prime example of the way local adjustments (in this case, water harvesting) accumulate across scales, affecting other systems that are then in turn felt again back at the local level (i.e., precipitation) (Shibuo et al., 2007; Cretaux et al., 2013; Stulina and Eshchanov, 2013). It is perhaps ironic, then, that the region home to the Aral Sea – Central Asia – is so often reported as the land of “no data available” in many pan-

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Eurasian studies that focus on the environment and/or human-environmental dynamics (for this recurring comment, see [Conrad et al., 2013](#); [Harris, 2010](#); [Lioubimtseva et al., 2005](#); [Mashkour and Tengberg, 2013](#); [Unger-Shayesteh et al., 2013](#)).

Both in the modern world and the human past, the key to a better understanding of socio-ecological dynamics at broad scales lies in describing such dynamics in unique local settings. Only through compiling numerous datasets can we begin to build broader interpretive frameworks about the human and environmental past. This approach is the opposite of taking a top-down continental view, and instead focuses on the scale people lived and acted within. It focuses on local responses to changing social and physical environments, and uses that knowledge to recognize patterns that build out to larger and larger scales. Such knowledge about how people react(ed) bridges the gap between esoteric anthropological and scientific knowledge and pragmatic action in the modern world. Especially in regions where there is a long history of intense human occupation, we are afforded the opportunity to investigate the cumulative, diachronic effect of intertwined social and environmental landscapes.

1.1. The Murghab as a venue for local-scale dynamics

The Murghab alluvial fan in what is now Turkmenistan is a unique laboratory for investigating the long-term and far-reaching effects of human-environmental dynamics. Although comparisons have been made between the Murghab region and the alluvial plains of Mesopotamia ([Zauderer, 1985](#); [Kohl, 2007](#)) or the Indus Valley ([Lisitsina, 1981](#)), different social and environmental processes unfolded and intertwined in each region throughout prehistory, and this area should not be understood as a “little Mesopotamia” ([Kohl 1981](#): xi) (see a similar argument made for the Zeravshan Valley in [Stride et al., 2009](#)). Compared to other landlocked alluvial regions in Eurasia, the main channel of the Murghab hydrological system was relatively stable during the Holocene ([Cremaschi, 1998, 2000](#); [Marcolongo and Mozzi, 1998](#); [Castellani, 2001, 2002](#); [Ninfo and Perego, 2006](#)), allowing alluvial sediments to build up atop archaeological sites in the proximal southern portion of the fan ([Cerasetti, 2008](#); [Sarianidi, 1981](#); [Tosi and Cerasetti, 2010](#)). Although the central and distal portions of the Murghab fan are much more hydrologically dynamic, the stability of the main trunk differentiates this system from other floodplains and oases in Eurasia whose entire hydrologic patterns were so unstable as to leave behind “ghost” landscapes in relict flow zones, for example in northwest China's Tarim Basin ([Tang et al., 2013](#)) and the Balkh plain of northern Afghanistan ([Fouache et al., 2012](#)).

The Murghab system has nonetheless experienced some periods of marked hydrological shifts ([Cerasetti, 2008](#); [Tosi and Cerasetti, 2010](#)), which in this arid region necessarily affected people's use of and interaction with the landscape. The modern era has seen major mechanized agriculture and canal diversion transform the Murghab region, with drastic and unexpected consequences for local farmers and Central Asian hydrology ([Nesbitt and O'Hara, 2000](#); [Zonn and Kostianoy, 2014](#)). But the dynamics of human-environmental interaction stretch back into antiquity, with the later phases of the Bronze Age and transition to the Iron Age (spanning ca. 1900–1000 BCE) being an especially interesting period because geomorphological, hydrological, and archaeological studies all point to significant adjustments in the socio-ecological regime during this time. In both the modern and ancient case, it is tempting to examine the local environment, hydrology, and socio-political systems as independent vectors for change, but they are in reality so entangled that to isolate each from the others presents an incomplete understanding of how humans and their physical environments shaped one another (cf. [Tang et al., 2013](#)). In

order to examine such processes, it is necessary to focus on the ways humans caused, recognized, interpreted, and/or reacted to fluctuations in their surroundings at local scales, and then interpret the reverberations of their behaviors at larger scales. Archaeology – with its inherently long-term dataset of localized events – is thus an important tool in the construction of our understanding of human-environmental dynamics through time.

1.2. Goals of the present work

Building on the strengths of the archaeological record – which combines data on both local-scale events and long-term diachronic changes – the aim of the present study is to look at a major period of socio-environmental fluctuation in Central Asian history. Our goal is to contribute to the current working knowledge of the second half of the 2nd millennium BC Murghab alluvial fan in light of the most recent survey data ([Cerasetti, 2012](#)). This period was characterized by systemic changes in the physical, socio-political, and demographic environment, processes that were necessarily intertwined but have often been examined in isolation or as direct causal factors in one direction or the other ([Kuz'mina and Lyapin, 1984](#); [Lyapin, 1996](#)). We purposely avoid an explicit attempt at disentanglement, and instead focus on one aspect of human-environmental dynamics that would have been critical for group living in an arid zone, namely, the relationship between site location and ancient watercourses (palaeochannels). Although the implications of our analysis should be considered speculative, they nonetheless add to the growing body of socio-environmental data that is being used to (re)assess prehistoric relationships between human settlement, water, and landscape. By examining how communities situated themselves with respect to water resources through time in the Murghab, and especially during a period when natural and social patterns seem to be in flux, we aim to contribute valuable micro-scale information that engages with syntheses being generated at broader scales of Eurasian prehistoric study.

2. Regional setting of the Murghab alluvial fan

The Murghab alluvial fan is an internal drainage system located in present-day southern Turkmenistan ([Fig. 1](#)). Along with the Tedjen alluvial fan, the Aral Sea, and the Caspian Sea, the Murghab alluvial fan (sometimes also referred to as the Murghab Oasis or the Murghab Delta) marks one of several terminal features in western Central Asia that make up an extremely large endorheic region ([Cretaux et al., 2013](#); [Markofsky et al., this volume](#); [Rustamov, 2014](#)). The closed Tedjen and Murghab hydrologic systems, in particular, occupy the Turan plain, which is filled with the alluvial deposits of these and other systems (including the Amu Darya) originating in the western Hindu Kush range ([Atamuradov, 1994](#); [Marcolongo and Mozzi, 1998](#); [Zonn and Esenov, 2014](#)). The Murghab River is the second largest river in Turkmenistan, and like all of the country's other major rivers it originates beyond the national borders, in this case in the Paropamisus Mountains of Afghanistan; about 350 km of the river's 800 km total length are located in Turkmenistan ([Zonn, 2014b](#)). The Murghab River flows to the northwest, forming the ca. 35,000 sq km Murghab alluvial plain before evaporating in the lowlands of the Karakum Desert. The Murghab floodplain is part of the 3% of the total land located within present-day Turkmenistan that is suitable for agriculture; of the remaining territory, roughly 80% is desert and 17% is either mountain or stony desert ([Babaev, 1994](#); [Lioubimtseva et al., 2014](#)).

The palaeogeography and tectonics of the region indicate the Turan plain, on which the Murghab alluvial fan is formed, tips downward toward the northwest. This regional tilt, along with active tectonics ([Thomas et al., 2009](#)), has caused both the Tedjen

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