Quaternary International 342 (2014) 57–72

Contents lists available at ScienceDirect

Quaternary International

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

Late Quaternary landscape evolution, soil stratigraphy, and geoarchaeology of the Caprock Canyonlands, Northwest Texas, USA

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ARTICLE INFO

Article history:
Available online 4 August 2014

Keywords:
Late Quaternary
Geoarchaeology
Landscape evolution
Soil stratigraphy

ABSTRACT

In northwest Texas, USA, between the Southern High Plains to the west and the Central Lowlands to the east, lies a geographic boundary known as the "Escarpment Breaks" or "Caprock Canyonlands." The canyonlands contain abundant springs, lithic resources, shelter, and plant and animal food sources that attracted hunter-gatherer groups. A geoarchaeological study was conducted in the canyonlands to determine the effects of late-Quaternary landscape evolution, especially intensive erosion, on the region's archaeological record. Geomorphic and stratigraphic field research and a total of 95 new radiocarbon age determinations, 94 of which were determined on paired samples, aid in reconstructing an understudied dynamic and erosive landscape, and explain how the landscape has changed. The pattern is similar to reported data from the Central Plains and western Rolling Plains but dissimilar to the Southern High Plains. High rates of erosion and geological controls on the South Fork of the Double Mountain Fork of the Brazos River, a 4th order stream, have hindered the discovery of deeply buried soils and *in situ* Paleoindian artifacts and features, but a late-Holocene pedocomplex is relatively intact in valley fills beneath remnants of the T-2 terrace of the South Fork. The eroding slopes near the edge of the caprock escarpment exposed a record of *in situ* Archaic to Protohistoric-aged materials. The eroding slopes should be targeted for future quantification of erosion and archaeological preservation bias for the canyonlands.

1. Introduction

A steep, abrupt, approximately 300 km-long north-south escarpment marks the eastern edge of the westward eroding Southern High Plains in Northwest Texas. This physiographic boundary, referred to locally as either the "Escarpment Breaks" (Texas Parks and Wildlife, 2011) or "Caprock Canyonlands" (Flores, 1990; Boyd, 2004) (hereafter: canyonlands), is defined by rugged incised canyons, remnant mesas, and alluvial outwashes (Fig. 1; Gustavson and Simpkins, 1989). The Brazos, Canadian, Red, and White rivers flow west to east through the canyonlands, where the topography transitions to more gentle hills of the Osage Plains section of the Central Lowlands physiographic province (Ferring, 1995; USGS, 2002), referred to locally as the Rolling Plains. Regional topographic diversity occurs along the escarpment, but in general, with the Rolling Plains to the east and High Plains plateau to the west, the canyonlands landscape stands out in sharp contrast to its surroundings.

The canyonlands mark a distinctive geographic boundary between the Southern High Plains to the west and the Rolling Plains to the east, making it an ideal area to assess archaeological and geoarchaeological questions in relation to the adjacent physiographic regions by examining late-Quaternary landforms and soils. Ongoing interdisciplinary research near Post, Texas (see Backhouse and Johnson, 2007a), is providing new information about hunter-gatherer landscape interactions, including hearthstone and lithic procurement strategies in the region (see: Backhouse and Johnson, 2007b; Backhouse et al., 2009, 2010; Hurst et al., 2010). Here, as part of the interdisciplinary effort, we evaluate the landscape evolution of a portion of the canyonlands along the South Fork of the Double Mountain Fork of the Brazos River (hereafter: South Fork) within the broader regional context of the Southern Plains. We compare soil-stratigraphic records from the Great Plains (e.g., Blum et al., 1992; Mandel, 1992, 2006, 2008; Bettis and Mandel, 2002; Thurmond and Wyckoff, 2004; Quigg et al., 2010; Beeton and Mandel, 2011) with the record from the canyonlands to create a more robust understanding of the landscape and to provide

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http://dx.doi.org/10.1016/j.quaint.2014.06.060
1040-6182/

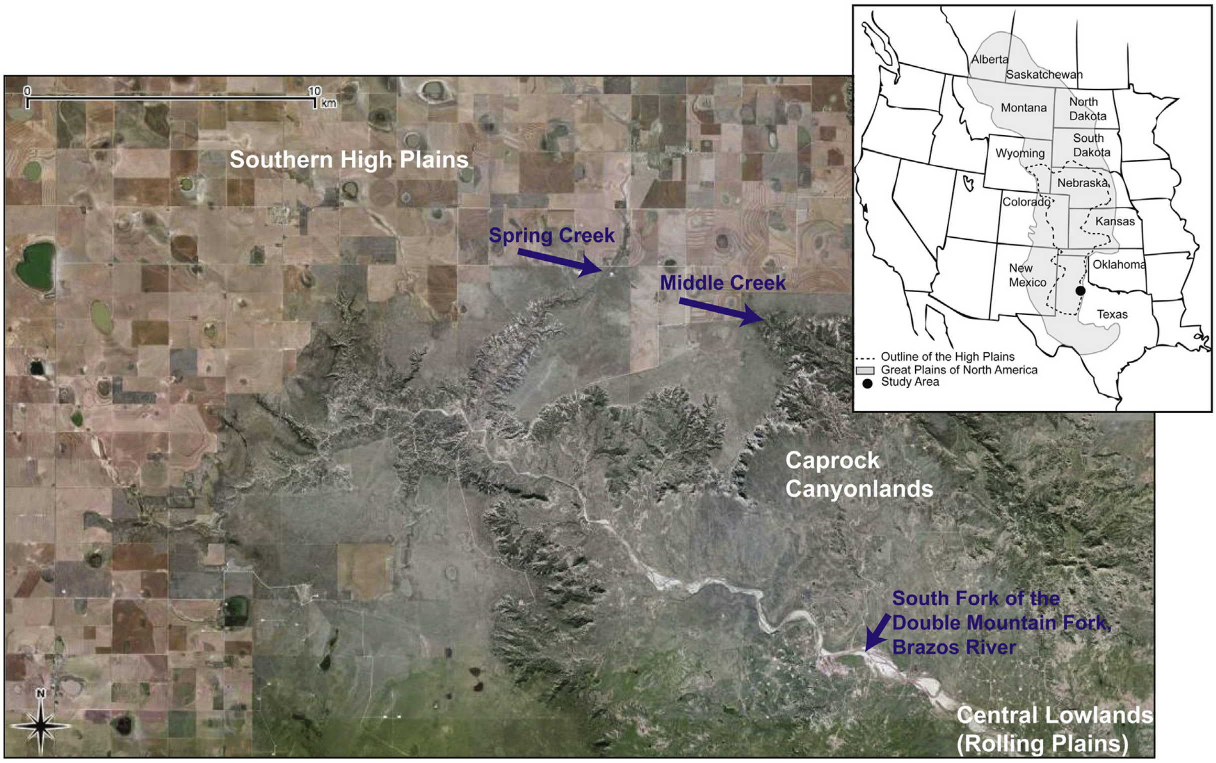

Fig. 1. Map of physiographic provinces and streams within the study area.

context for archaeological materials, and assess the potential for future archaeological site discovery.

We framed our study around generalized conceptual models for landscape evolution, landform stability, and geomorphic bias in the archaeological record. First, we consider a general late-Quaternary "geoclimatic" conceptual model, which emphasizes that climate processes drive geomorphology to a large extent. In other words, destabilization and stabilization of the landscape are tied to climate patterns, where precipitation influences vegetation cover, erosion, and fluvial aggradation and degradation (Hall, 1990; Bull, 1991). For example, arid climate in the Great Plains during the mid-Holocene caused loss of vegetation, which led to landscape destabilization, an increase in erosion, alluviation on the Central and Northern Plains (Antevs, 1952; Clayton et al., 1976; Mandel, 1995; Artz, 2000), and eolian sedimentation on the Southern Plains (Holliday, 1989b, 1995, 2000, 2001). Region-wide examination and radiocarbon dating of sediments and soils preserved in alluvial landforms (e.g. terraces and fans) of the Central Plains have revealed coeval patterns of erosion and deposition based on stream order and landscape position (see: Mandel, 1992, 2006, 2008; Bettis and Mandel, 2002; Beeton and Mandel, 2011). Although a late-Quaternary geoclimatic model is well established for the Great Plains, less is known about the specific geoclimatic patterns within the highly erosive canyonlands.

Second, we evaluate the relationship between geomorphology and the archaeological record with a conceptual geoarchaeological landscape model for the western Rolling Plains of Texas. The model is based on a geomorphic and archaeological survey for the Justiceburg Reservoir (now known as Lake Alan Henry; Blum, 1989; Blum et al., 1992) and known periods of soil development/stability and "catastrophic stripping" from the reservoir area (Boyd, 1997). Based on geomorphic patterns, the model presupposes that a strong (positive) relationship exists between the relative volume of preserved sediment and the recorded archaeological inventory. Thus, "in order to achieve a more representative archeological record, sediments that are preserved should be examined at a level of intensity that is inversely proportional to their occurrence on the landscape" (Blum, 1989: 106). In other words, it is not enough to consider geomorphic patterns during or after archaeological survey, but use them to develop subsurface archaeological reconnaissance strategies central to research design.

Understanding the soil and sediment archives and their spatial-temporal erosional and depositional patterns in the region is a crucial step for assessing the presence and absence of prehistoric cultural activities. Investigations at the Lubbock Lake Landmark (Johnson, 1987), and elsewhere on the Southern High Plains, have identified intact buried archaeological assemblages and surface sites with diagnostic artifacts (e.g., projectile points, ceramics) that span the past ~12,000 B.P. (Johnson and Holliday, 2004; Johnson, 2008). Archaeological evidence from the western Rolling Plains indicates people inhabited the region since ~10,800 B.P. Given that humans have been occupying the region continuously since ca. 12,000 B.P., understanding spatial-temporal landscape patterns is a key to assessing disproportional archaeological evidence from different cultural periods, i.e. archaeological preservation bias. Furthermore, understanding the spatial-temporal patterns allows archaeologists to create informed research designs, and aid in targeting archaeological surveys to specific periods. However, little is known about the soil and sediment fills within the canyonlands themselves compared to the adjacent regions, except for two studies initiated by cultural resource management (CRM) projects (i.e. Boyd, 1997; Quigg et al., 2010). In this paper, we present observations based upon extensive field study and radiocarbon ages, contribute new landscape evolution and soil stratigraphic results to an understudied dynamic and erosive landscape, and discuss how the landscape in the region has evolved geomorphically. We reconstruct the spatial-temporal landscape patterns to understand preservation patterns of archaeological material, and identify areas for future archaeological reconnaissance.