



# Macrophysical Climate Modeling, economy, and social organization in Early Bronze Age Anatolia



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## ABSTRACT

The northern extremity of Mesopotamia, also known as the Hilly Flanks of the Fertile Crescent, witnessed a series of major sociopolitical and economic transformations during the Bronze Age, which led to the emergence of specialized pastoralism in the third millennium BC. This research focuses on the application of Macrophysical Climate Modeling (MCM) to eastern and southeastern Anatolia and correlates the results with the Early Bronze Age (ca. 3000–2000 BC) settlement patterns of the region. Changes in settlement systems throughout the Early Bronze Age are assessed from the perspective of heterarchic social organization and how various forms of pastoralism might have been used as adaptation to aridity. The significance of this research is that using the MCM the paleoclimatic backdrop is established for such adaptations, which may be used to study the long-term dynamics of human–environment relations.

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## 1. Introduction

Arguably, one of the most significant phases of social change in the ancient history of the Near East is the Bronze Age (BA) (ca. 3300–1200 BC). Building on the economic and social transformations of the Neolithic and Chalcolithic periods in the preceding six millennia, the BA witnessed the emergence and rise of state-level formations (Earle, 2002; Rothman, 2001). Although many factors contributed to widespread socio-political transformations such as centralized administration, standardized mass production, and social stratification, it can be argued that the major driver of these changes was the attempt at economic maximization in human societies (Tainter, 1990). At the same time, an increasing amount of paleoenvironmental research (e.g., Horowitz, 2001; Hunt et al., 2007; Kuzucuoğlu and Marro, 2007; Roberts et al., 2011) suggests that the climate of the ancient Near East changed significantly around the time of the emergence of states. The current climatic conditions in the region, which are warmer and drier in comparison to the early Holocene, developed during the BA.

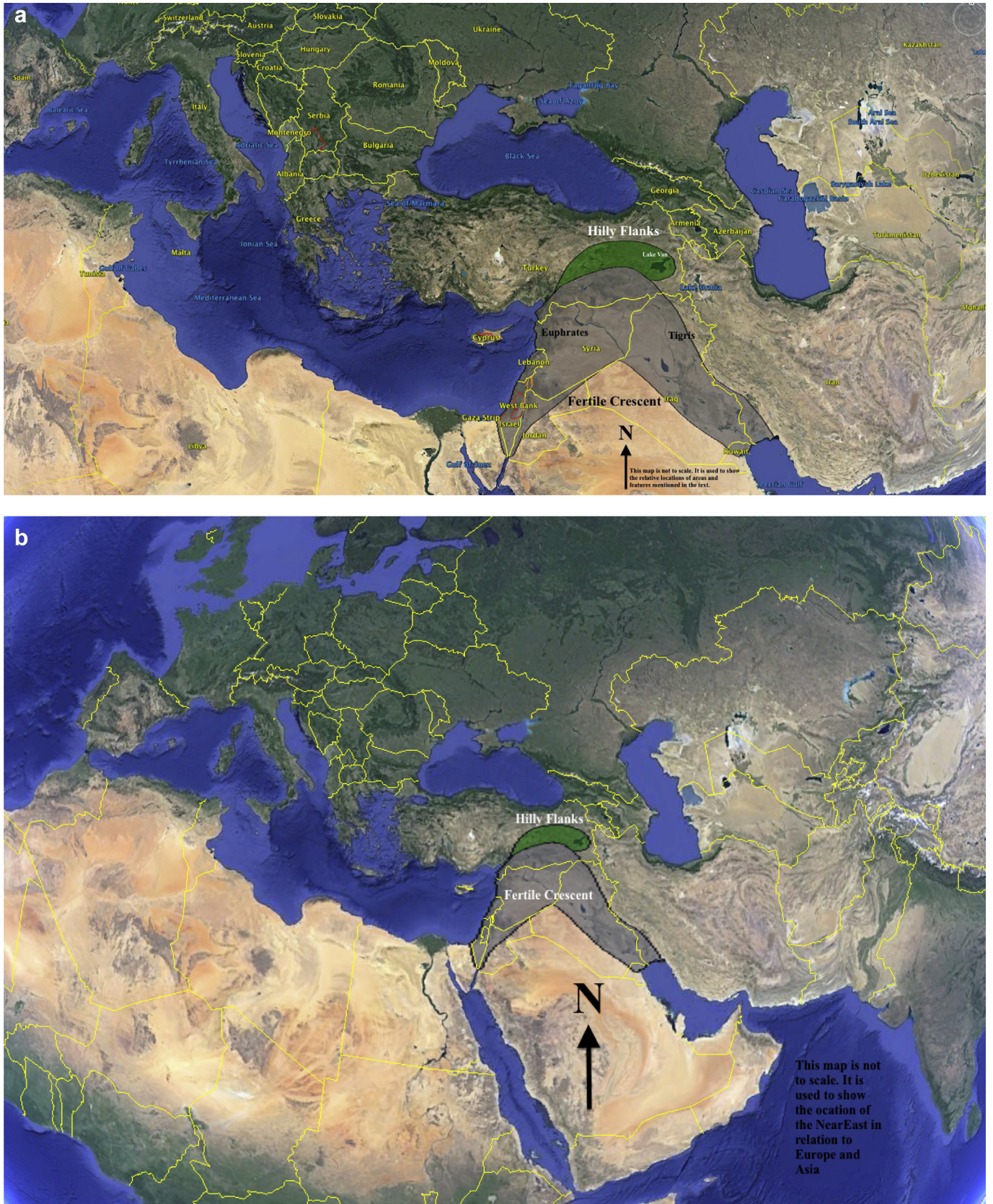
This research emphasizes the intricate and multi-dimensional relationships between environment and human socioecosystems from the perspective of complex adaptive systems. According to the concept of complex adaptive systems, social change not only affects both sides of the equation (i.e., humans change as they

adapt to natural changes and initiate their own changes in the ecosystems) but is continual due to the feedback mechanisms in the ecosystem (Redman, 2005; Van der Leeuw and McGlade, 1997). Consequently, a better and more complete understanding of multifaceted socio-economic and political transitions during the BA is only possible when human–environment relationships from this period are explored and tested against the numerous hypotheses that consider long-term changes in the environment, adaptive human behavior, and long-term human impacts on the environment.

This research focuses on several interconnected issues. First, it aims to reconstruct paleoclimatic conditions during the BA in the upper Euphrates and upper Tigris basins in eastern and southeastern Anatolia using the Macrophysical Climate Model (MCM). This region constitutes the “Hilly Flanks of the Fertile Crescent” (Fig. 1a and b) (Braidwood and Howe, 1960). Second, it aims to assess Early Bronze Age (hereafter EB, ca. 3000–2000 BC) settlement systems and social organization from the perspective of nomadic transhumant pastoralism. Through the correlation of climatic changes with the development of EB settlement systems, we can better understand how human groups adjust the type and intensity of land use patterns while dealing with a changing environment. Such changes in these patterns have been well documented in the EB sites of the upper Euphrates Basin, such as Arslantepe (Frangipane, 2012; Palumbi, 2012; Restelli et al., 2010). Consequently, this research will bring a new perspective to assess the shifts in social organization and economic structure from a dynamic, long-term adaptive perspective.

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**Fig. 1.** a. Map of southwest Asia showing modern political boundaries. The gray outline shows the Fertile Crescent. The green outline shows the Hilly Flanks of the Fertile Crescent, which also contains the headwaters of the Euphrates and Tigris rivers. b. Map of southwest Asia in relation to Europe, Africa, and Asia. The grey outline shows the Fertile Crescent. The green outline shows the Hilly Flanks of the Fertile Crescent. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

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