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The relationship between Early Holocene climate change and Neolithic settlement in Central Anatolia, Turkey: current issues and prospects for future research

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ABSTRACT – *Episodes of global climate change have traditionally been invoked as explanations for settlement re-organisation and socio-economic transformation in the prehistory of the Middle East (*e.g.*, the Neolithic period). By focusing on the 8.2K event, this paper presents a theoretical and methodological argument against the assumption of unilinear, passive responses by prehistoric societies to global climate change, using as a case study datasets recently obtained from the Konya Plain in Central Anatolia, Turkey.*

IZVLEČEK – *Pri pojasnjevanju epizod velikih preoblikovanj naselij in družbeno-ekonomskega prehoda v prazgodovini Srednjega Vzhoda (*e.g.*, neolitika), se običajno sklicujemo na epizode globalnih klimatskih sprememb. Z osredotočenjem na klimatski dogodek pred 8.2K, v tem članku podajamo teoretični in metodološki dokaz zoper domnevo o premočrtnih, pasivnih odgovorih prazgodovinskih družb na globalno klimatsko spremembo. Kot študijski primer smo uporabili nedavno pridobljeno serijo podatkov s planote Konya v centralni Anatoliji, Turčija.*

KEY WORDS – *climate change; 8.2k event; Central Anatolia; Konya Plain*

Introduction

The impact of environmental change on human societies has been a traditional concern of palaeo-ecological and archaeological research (*Rosen 2007*). Processes as diverse as human migrations, plant and animal domestication, the restructuring of settlement patterns (*e.g.* site abandonment) and socio-economic transformations have often been attributed to the impact of climate change and/or human impact on the landscape and its resources (*Redman 1999*). With regard to the archaeological investigation of such inter-relationships, the issues of the scale and resolution of the archaeological and the palaeo-ecological record are of paramount importance. First, it is necessary to verify independently the magnitude, scale and specific ecological impact of episodes of climate change on landscape resources. Second, one must evaluate and assess within a defined spatial and chronological framework the aspects of the archaeological record (*e.g.*, landscape exploitation, settlement patterns) that might hold evidence of those human choices and decision-making that took shape as a response to climate (and resulting landscape) change.

In the Middle East, the end of the Early Neolithic period has been variously associated by a number of scholars with climatic deterioration (characterized by cold conditions bringing about increasing aridity) occurring at about 8200 years calBP and lasting for <400 years (see *Alley et al. 1997; Wiersma et al. 2006*). The 8.2k event is believed to have forced the widespread abandonment of settlements, with consequent population diffusion and the spread of settlement westwards into Southeast Europe (see contributions in this volume; also *Weninger et al. 2006*). Such assumptions have often been based on constructing generalized radiocarbon sequences, spanning both local and regional chronologies, which are

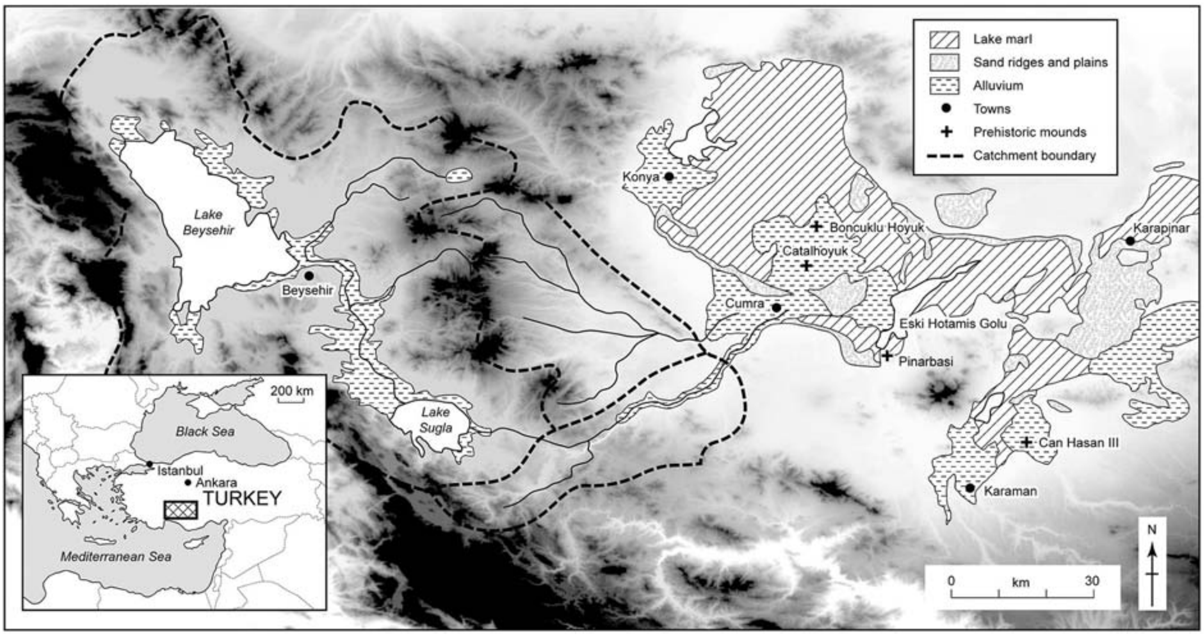

Fig. 1. Map of the Konya plain in central Anatolia, showing the excavated Neolithic sites, and the main topographic features and landscape units.

then 'correlated' in order to build chronological sequences aimed at demonstrating cultural genealogies (whereby the chronologically 'older' represents the source, and the 'younger' its derivative). However, such arguments tend to ignore the fact that, in order to establish causality between climate and cultural change, it is not enough to demonstrate broad chronological contemporaneity between the two. Proof consists of correlating records of climate change with evidence for its specific impact on the landscape resources exploited by past societies (*e.g.* vegetation, water sources), and the subsequent impact of such landscape transformations upon human choices as reflected in prehistoric habitation practices and settlement patterns. However, most scholarly arguments in favor of climate-driven explanations tend to ignore evidence pertaining to local variations in patterns of landscape and (associated?) socio-cultural change (often treating it as 'noise') by subsuming it under grand narratives of regional 'trends'. They may thus overlook critical evidence for diversity in both the configuration of the local landscapes and the living strategies of prehistoric communities. The aim of this paper is to question the assumption (sometimes uncritically promoted by palaeo-ecologists) of passive responses by prehistoric societies to climate change.

Case study: the Konya Plain, Central Anatolia

The Konya Plain of Central Anatolia (Fig. 1) was chosen as a case study due to its unusual concentration of archaeological and palaeo-ecological research designed and carried out by research teams aiming at the integration of on-site (geo-archaeological, subsistence) and off-site (palaeo-ecological) evidence, in addition to intensive survey and excavation work (overviews available in *Boyer et al. 2006; Baird 2002; 2007; Eastwood et al. 2007; Hodder 2007; Roberts et al. 1999; 2001; 2007*). Here, I will present a brief summary of the findings of these different projects, in order to demonstrate the rationale behind integrating diverse lines of evidence for reconstructing the complexity of human-environment interactions in the Neolithic (for detailed presentations of the evidence discussed here, the reader is referred to the original publications).

The available pollen sequences from Central Anatolia (*Eastwood et al. 2007; Roberts et al. 2001*) have shown that by the time of the first known Neolithic settlement in Cappadocia (*c.* 10 000 calBP) the regional vegetation was oak-terebinth-juniper grass parkland. Two millennia later (*c.* 8000 calBP, the beginning of the main Ceramic Neolithic occupation at Çatalhöyük) the regional landscape had been transformed into a mosaic of woodland (including some mesic species such as hazel) and more open grassland. Although by 6000 calBP mesic taxa had regressed, the available evidence indicates that deciduous oak continued to expand until the mid-Holocene, when there was a permanent decline in oak woodland, which was replaced by a more open landscape. The widespread occurrence of other tree species such as pine has invariably been interpreted as the result of long-distance transport. High-resolution isotope, diatom, mineralogical and lithological data also demonstrate deep, dilute lake conditions from the beginning of the Holocene until *c.* 6500 calBP. After this time there was a permanent fall in lake levels, with maximum salinity levels probably being achieved around 3000–2000 calBP. Pollen and limnological records are in agreement in demonstrating a sequence indicating a rapid climate improvement at the start of the Holocene, followed by a sustained period of moisture availability significantly above modern values until *c.* 6500 calBP, with much drier conditions prevailing during the second half of the Holocene. Anthropogenic impacts on vegetation did not become major features of the local landscape before *c.* 4500–4000 calBP, which is in agreement with comparable evidence for low Neolithic impact on woodland vegetation in SE Europe (*Willis and Bennet 1994*). However, the response of tree taxa in Anatolia to increasing moisture availability during the Early Holocene has also indicated significant time lags in their expansion, which might be attributable to the combined effects of poor pollen preservation and Neolithic landscape practices (*e.g.*, vegetation burning, coppicing during pollination periods, etc., which might be difficult to detect by the classic indicators of anthropogenic impact deployed in pollen analysis; *Roberts 2002*). The analysis of charcoal macro-remains has also demonstrated the regular exploitation of numerous tree and shrub taxa which are not preserved at all (*e.g.* Rosaceae) in the local pollen diagrams (*Asouti and Hather 2001; Asouti 2005*).

With regard to geo-archaeological investigations in the Konya Plain, an intensive coring program was undertaken by the KOPAL team (*Boyer et al. 2006*) to investigate the depositional history of the Çarşamba alluvial fan, in order to reconstruct the configuration of the local landscape and its hydrological regime. These data have indicated that the so-called 'Lower Alluvium' (backswamp clay, interpreted as an indicator of extensive flooding occurring at regular intervals) was actively deposited during the greater part of the Neolithic. Its deposition in the periphery of the Çarşamba fan continued after the onset of the Chalcolithic period (*c.* 6000 calBC), when the so-called 'Upper Alluvium' (indicative of a change to drier conditions) had begun to accumulate. This sedimentary sequence indicates that a complex topography (comprising both wet and well-drained surfaces) was available to the inhabitants of the area throughout the prehistoric period (*Boyer et al. 2006*).

The same complexity is evident for the Neolithic period (9^{th}–7^{th} millennia calBC). Recent systematic work on mud bricks and a pilot coring project undertaken by a joint Oxford-Sheffield team around Çatalhöyük (*Doherty et al. 2008*) plus a landscape project undertaken by a Liverpool team led by the author in the vicinity of the aceramic site of Boncuklu (*work in progress*) have conclusively demonstrated that there is significant micro-topographic variability around both sites, which is not necessarily picked up by the general Lower-Upper alluvium succession model proposed by the KOPAL project. This topographic variability seems to be a persistent feature of the Neolithic (and later) local landscape and, as such, is not generally conducive to climate-driven inferences with regard to its causes at any particular period.

Turning briefly to settlement patterns in relation to landscape configuration: plotting the results of sediment coring investigations against settlement distribution (*Boyer et al. 2006.Fig. 5*) shows that settlement expansion and contraction occurred independently of major shifts in topography and the hydrological balance of the Çarşamba alluvial floodplain and fan. Prior to the mid-8^{th} millennium calBC (*i.e.* in the early Aceramic Neolithic), settlement appears to have been dispersed, taking advantage of different landscape units, including both marshes and better drained areas. In the late Aceramic Neolithic (to which dates the first archaeologically known habitation at Çatalhöyük) this picture of diversity does not alter. During the Ceramic Neolithic (7^{th} millennium calBC), one can observe a process of settlement nucleation with the end of these Aceramic communities which resulted in the growth of the community of Çatalhöyük. This process again appears to be unrelated to any major episodes of environmental and/ or climate change (*Baird 2002*).

Discussion

Prospects for future research on the Neolithic landscapes of the Konya Plain focus on the diversity of local micro-topographies in relation to landscape practices (*e.g.* cultivation, herding, woodland exploitation, raw materials extraction), and are aimed at reconstructing the various pathways leading to the creation of anthropogenic landscapes. A core concern of this research is to address how Neolithic landscape practices and decision-making might have differed from traditional assumptions and expectations of catastrophic human impact on the 'natural' landscape (*e.g.* through overgrazing, deforestation and consequent land degradation). Such effects are habitually predicted by conceptual models of 'environmental collapse' (the latter often perceived as being accentuated and/or triggered by negative climate change). With specific reference to the Neolithic period, evidence for catastrophic human impact on the landscape at a scale sufficient to have caused settlement fragmentation and dislocation remains poorly documented across the region (*Campbell 2009*).

As regards the 8.2k event, there is also very limited evidence to suggest that it had a significant impact on settlement patterns and the resource base of Neolithic communities in central Anatolia. In effect, evidence unearthed during the most recent excavations at Çatalhöyük would suggest continuity rather than discontinuity in habitation patterns and practices between the Neolithic East Mound and the Chalcolithic West Mound (see *Çatalhöyük Archive Report 2008.13–15* and references therein). Overall, it seems that the proximate causes for the prevailing pattern of settlement nucleation observed during the *c.* 1000 year long habitation of the East Mound and the return to the fragmentation observed towards the end of the 7th millennium must be sought in economic and societal developments, rather than being considered as the ultimate result of environmental pressures exerted on prehistoric populations and communities (*Baird 2002*).

In addition to inferences drawn from the archaeological and palaeo-environmental record, the evidence pertaining to the magnitude and impact of the 8.2k event as an episode of global climate change has indicated that it was short in duration (*c.* 300 yrs). Recent simulations (*Wiersma and Renssen 2006*) have indicated that its effects as regards key parameters such as temperature and precipitation varied globally, regionally and even within individual geographical areas. This research suggests that vegetation and hydrological responses to such short-term events might have been extremely variable, and displayed significant time lags. Such evidence, together with the archaeological record, indicates that the 8.2k event is unlikely to form a sufficient explanation per se for the role of climate change as the primary or even a significant contributing factor to the 'collapse' of Early Neolithic settlement, and the subsequent spread of populations from the Middle East to continental Europe (*contra Weninger et al. 2006*).

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