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The Perfect Storm: A New Multicausal Model of the Political Collapse of Titiş
Höyük, an Early Bronze Age City-State in Southeastern Anatolia

A dissertation submitted in partial satisfaction of the requirements for the degree
Doctor of Philosophy

in

Anthropology

by

Adam William Schneider

Committee in charge:

Professor Guillermo Algaze, Chair
Professor Wolfgang Berger
Professor Neal Driscoll
Professor Paul Goldstein
Professor Margaret Schoeninger

2015

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Chair

University of California, San Diego

2015

DEDICATION

This dissertation is dedicated to my beloved wife, Alysha. Without her patience, support, and the benefit of her many valuable suggestions for revisions to early drafts, this volume would simply not exist.

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ABSTRACT OF THE DISSERTATION

The Perfect Storm: A New Multicausal Model of the Political Collapse of Tiriti Höyük, an Early Bronze Age City-State in Southeastern Anatolia

by

Adam William Schneider

Doctor of Philosophy in Anthropology

University of California, San Diego, 2015

Professor Guillermo Algaze, Chair

An issue that has been the subject of much archaeological attention in recent decades is the collapse of urban centers in northern Mesopotamia at the close of the Early Bronze Age. The causes of this regional contraction have been much debated. One obstacle to resolving this issue is the tendency to view the collapse of cities in this

region as a single phenomenon; another, related problem is the tendency of many archaeologists to seek an “ultimate” cause for these events, rather than dealing with each case individually.

In this dissertation, I investigate this archaeological phenomenon from a radically different perspective: the “event-based” approach to social transformation developed by historical sociologist William H. Sewell. Sewell’s approach to collapse emphasizes the articulation of multiple causal factors as the most effective way to study transformative historical events, including collapses. This study, which focuses on a single urban center – the site of Titriş Höyük, a small city-state located in the Lower Turkish Euphrates Valley – rather than the entire region, follows the Sewellian formula in bringing together archaeological, historical, ethnographic, and paleoclimatic evidence to develop a new multicausal model to explain the processes which, acting in concert, brought about the political disintegration of the polity. These data include a considerable body of new stable carbon, nitrogen, and oxygen isotope evidence to demonstrate how climate change; regional political developments; the collapse of long-distance networks of exchange and interaction; and the rise of a competitor, the city of Carchemish; all had an influence upon the decline of Titriş Höyük during the late 3rd millennium BC.

Chapter 1: An Introduction to the Research Problem

The sudden collapse of many cities and large territorial states throughout the Mesopotamian culture area at the close of the 3rd millennium BC ranks as one of the most intriguing and contentious issues in Mesopotamian archaeology. This process was especially severe in northern Mesopotamia, where a particularly high percentage of cities were abandoned. The depopulation of many cities in this area is all the more remarkable because it happened on the heels of a spectacular florescence of urbanism in the region during the middle centuries of the millennium. The sudden, dramatic retreat away from urbanism, economic specialization, and sociopolitical complexity is still not fully understood, and its causes and effects remain the subject of intense scrutiny and debate in the archaeological literature.

1.1: Explanations for the Destruction of Upper Mesopotamian Cities during the Final Centuries of the Early Bronze Age (c. 2300-2000 BC)

Although a number of explanations for the collapse have been put forward, there is no consensus among archaeologists as to what caused this episode of widespread collapse. For many archaeologists, the fate of cities in northern Mesopotamia is bound up in the rise and fall of the Akkadian Empire, which conquered much of the region c. 2300 BC. Another explanation, which I will refer to as the “4.2 ka hypothesis”, has aroused a great deal of controversy by rejecting the notion that historical events precipitated the collapse, and instead proposing that a

sudden and severe climate change was responsible for the urban abandonment of northern Mesopotamia.

The present study will present a new, multicausal explanatory model for the late 3rd millennium political collapse of an urban center in southeastern Turkey known as Titriş Höyük. This city was the dominant polity within a catchment area of the Lower Turkish Euphrates known as the Karababa Basin, which straddles the river between the modern towns of Hilvan and Halfeti. Titriş was one of many cities across Upper Mesopotamia that was abandoned at some point during the final centuries of the 3rd millennium. It is unique, however, in several ways. First and foremost, the site appears to have been a cultural crossroads that has yielded evidence of contacts not only with Syria and Mesopotamia, but also with the Caucasus, Anatolia, and even the Cycladic islands of the Aegean. The city is also unusual in that virtually the entirety of its occupation was, with the exception of a small medieval settlement, limited entirely to the period of the Early Bronze Age. Thus, Titriş Höyük is an excellent case study, because its emergence and collapse both occurred within this relatively short space of time.

Finally, the site has also yielded especially rich collections of human and faunal skeletal materials, which will be employed in this study to reconstruct the climate of this area and the diet of the ancient residents of Titriş during the course of the 3rd millennium BC. By analyzing the isotopic composition of human skeletal remains from Titriş burials, it becomes possible to study both the paleodiet of the city's urban inhabitants and also to observe whether Titriş experienced any significant

hydroclimatological changes during the course of the Early Bronze Age. Similarly, isotopic analyses of samples of ovicaprid tooth enamel found in multiple archaeological deposits at Titriş, as well as further samples of animal tooth enamel from two smaller nearby sites, Gritille Höyük and Hacinebi, this study will attempt to reconstruct the Early Bronze Age climatic history of the Karababa. As a result, these osteological materials from Titriş Höyük offer a unique opportunity to explore the local climatic and human prehistory of the city and its vicinity during the course of the millennium.

It is not possible, however, to fully appreciate the aims of this study without first understanding existing archaeological explanations of the late 3rd millennium collapse. Accordingly, these will be discussed below. I will begin by briefly describing some historically-based explanations, which principally focus on the Akkadian intrusion into northern Mesopotamia. Thereafter, I will examine the 4.2 ka hypothesis in more detail. Finally, I will introduce the current study, and provide a brief description of the organizational format for the remainder of this dissertation.

1.1.1: Historically-based explanations. As stated above, many explanations have portrayed the fate of urban centers in northern Mesopotamia as inextricably linked to the rise and fall of an empire that was not native to the area: the Akkadian Dynasty (c. 2350-2200 BC). This extraordinary polity – often credited as being the world’s first empire – came into being as the result of a palace coup in the Babylonian city of Kish by a usurper known to posterity as Sargon the Great (cf. Liverani 1995). During the campaigns of conquest in which he forged the first empire in the history of

the Near East, Sargon is reported by Akkadian royal propaganda to have blazed a trail of destruction that stretched northwest from their heartland in central Iraq all the way north into the Taurus mountain range and west to the Mediterranean Sea (Liverani 1995: 2356).

Some four decades after his death, Sargon's grandson Naram-Sin would repeat the exploits of his famous ancestor with fresh campaigns in northern Mesopotamia, including the destruction of the powerful city of Ebla in northern Syria (cf. Marchesi 2015b). Naram-Sin also established (or possibly re-established) firm bases of Akkadian power in Upper Mesopotamia, such as the city of Tell Brak in the Khabur Basin of northeastern Syria.¹ Naram-Sin's victories proved to be short-lived, however; his son, Šarkallišari, was (probably) the last ruler of the empire, and his reign was brought to an abrupt close by the invasion of a "barbarian" nomadic people from the Zagros mountains of Persia known as the Gutians (cf. Struve 1969: 43; Postgate 1992: 41).

Because of their dramatic intervention in local Upper Mesopotamian politics, and the large number of sources (often biased and self-serving) which attest to their military prowess, most historically-based explanations for the sudden decline of urban centers in Upper Mesopotamia consider the Akkadians to have been the catalyst of the process of collapse. For example, the great Soviet Assyriologist, V.V. Struve, cast the calamitous final years of Akkadian dominance over the Near East (including northern

¹ In fact, bricks from the so-called "Naram-Sin Palace" at Tell Brak had the king's name stamped on them, so as to make him a literal part of the foundation of local Akkadian dominion (cf. Akkermans and Schwartz 2003: 279).

Mesopotamia) in appropriately Marxist terms, arguing that the alienation of enslaved native populations from ownership in the means of production had resulted in internal warfare and widespread anti-Akkadian resistance (cf. Struve 1969: 41-43). This disunity was, in turn, to fatally weaken the empire, and its eventual collapse resulted in chaos and bloodshed across the entire area of its control (*ibid*).

More recently, it has been argued that a particular episode of Akkadian aggression proved to be a self-inflicted and serious economic blow. The destruction of the vital Levantine trading port of Byblos by the Akkadians may have resulted in an inability on the part of the Empire or its Upper Mesopotamian possessions to generate much-needed capital via Mediterranean trade (Butzer 1997: 282). Interestingly, both of these narratives share a common and almost moralistic thread: the rapacious, war-like nature of the Akkadian state, which was an integral aspect of its initial success, ultimately proved to be its undoing.

One weakness of these historically-based models is that the explanations for causes of urban decline in Upper Mesopotamia at the close of the 3rd millennium BC are often rather nebulous (with the exception of cities such as Ebla, where the military intervention of the Akkadian Empire is directly attributed as the cause of urban collapse by ancient sources.) It must be said, however, that the vagueness of many historical explanations is a reflection of the ancient records upon which they are largely based. Indeed, most of the extant texts which date from the Akkadian Period are administrative documents concerned with practical matters like wages and accounting, but contain precious little in terms of historical events. Staubwasser and

Weiss give voice to the frustration of thousands of archaeologists when they note that “the laconic cuneiform sources provide much information but few details for the Akkadian imperial collapse” (2006: 382).

1.1.2: The 4.2 KA hypothesis. In 1993, an article published by Weiss *et al.* in *Science* recast the entire question in radically new terms, fingering an abrupt climate change event called the “4.2 ka event” as the catalyst for the sudden and widespread decline of urban centers in northern Mesopotamia (Weiss *et al.*, 1993). According to the authors of this study, a shift in climate resulted in a period of severe droughts that had brought about this wave of collapses in approximately 2200 BC. In an ironic twist on the more traditional view that Akkadian aggression was the primary cause of urban collapse in the north, Weiss *et al.* turn this hypothesis on its head, arguing that the climatically-driven abandonment of Leilan and other cities in the rich agricultural belt of northern Syria deprived Akkad of a valuable breadbasket, and ultimately resulted in the downfall of the Akkadian Empire (*ibid*: 1002).

Weiss *et al.*, inferred the onset of drought conditions in northern Mesopotamia from the composition of late 3rd millennium sedimentary sequences at three sites located in the catchment basin of the Khabur River of northeastern Syria: the large urban center of Tell Leilan and two smaller sites, Abu Hgeira and Abu Hafur, some 50 km southwest of Leilan (*ibid*: 1000). At Tell Leilan, the largest and most important of the three sites, “a rapid evolution in depositional conditions” was noted in the stratigraphy of Trench B (*ibid*: 999), which was found to coincide with the abandonment of the city at approximately 2200 BC. Of particular importance was the

composition of a late 3rd millennium stratum that subsisted of a volcanic ash mixed with other particles, such as fine silt phytoliths, fragments of volcanic glass, and calcitic silt, that “are characteristic of both local strong wind deflation and long-distance aeolian transport” (*ibid*: 1000); these sedimentary features, which differ significantly from those of earlier levels, were interpreted as indicators of “marked aridity induced by intensification of wind circulation, and an apparent increase of dust veil frequency compared to present-day conditions” (*ibid*). As at Tell Leilan, similar tephra-rich deposits in the soil-stratigraphic record of Abu Hgeira and Abu Hafur were also reported by the authors as coinciding with the abandonment of both sites in the late 3rd millennium (*ibid*: 1000-01).

Based on the sedimentary evidence from these three sites, Weiss *et al.*, concluded that cities throughout northern Mesopotamia had been deserted (as it were) as a result of “desertification, intensified wind turbulence, and increased dust veil [which] significantly reduced soil moisture reserves, increased aeolian loss of soils, and reduced ground visibility” caused by the 4.2 ka event (*ibid*: 1002). Moreover, because the presence of volcanic particles in stratigraphic layers was temporally correlated with the collapse of Leilan, Abu Hgeira, and Abu Hafur, Weiss *et al* concluded that a previously unknown volcanic eruption in the Taurus, or possibly the southern Caucasus, was probably the trigger for the abrupt climate change that took place c. 2200 BC (1993: 1001-02).

Although the central contention of the 4.2 ka hypothesis – that drought in 2200 BC caused the sudden collapse of polities across the Mesopotamian culture area – has

remained largely unchanged since first being proposed in 1993, explanations for the causal mechanisms responsible for triggering the 4.2 ka event have since been revised. Specifically, it has become increasingly clear that there is little evidence of such a significant volcanic event in either the Greenland ice core record (Butzer 1997: 250), or in deep sea sediment cores in the eastern Mediterranean (*ibid*) or the Arabian Gulf (Cullen *et al.*, 2000), and the suggestion that a volcanic eruption was the cause of the 4.2 ka event has been de-emphasized.² Staubwasser and Weiss, writing in 2006, make virtually no mention of volcanism at all, suggesting instead that a fluctuation in the El Nino Southern Oscillation (ENSO) caused by “change in southern East African tropical convection intensity around 4.2 ka [which] may have altered upper-level flow and wave pattern in the Northern Hemisphere subtropics particularly over the Middle East” was the trigger for the 4.2 ka event (2006: 383).

Despite the revision of the model and the shift away from an undocumented volcanic event, the 4.2 ka hypothesis continues to be criticized by many scholars who cite contrary paleoclimatological evidence as an indication that the model is unsound. A 2003 analysis of a stalagmite recovered from Qunf Cave in southern Oman, for instance, reported finding no evidence of a 4.2 ka event (Fleitmann *et al.*, 2003). Moreover, as I will show in Chapters 8 and 9, although the regional paleoclimatic proxy record for the Near East, as well as that of the wider Eastern Mediterranean Basin, both provide evidence for a trend towards drier conditions during the late 3rd

² A report on the Early Bronze Age soil-stratigraphic composition of Trench 80-85 at Titriş Höyük also found that there was no significant discontinuity in the stratigraphic sequence to correspond with such an event. (Wolff and Goldberg 2008, *unpublished*.)

millennium BC, proxy data from these areas present a much more complex (not to say confused) picture of the 3rd millennium climate history of these areas.

In addition to those critiques of the hypothesis grounded in paleoclimatology, another challenge to the 4.2 ka hypothesis is that some of the historical evidence cited to support the model is suspect. For instance, Staubwasser and Weiss choose to cite the pseudo-historical legend of the downfall of the Akkadian Dynasty that is known as the Curse of Agade as their primary example of contemporary historical evidence for drought-driven collapse (cf. 2006: 382). On the surface, it is reasonable for them to cite this extraordinary document, as it is one of the few detailed accounts of the Akkadian collapse left to historians. However, many specialists in Sumerian literature have argued that the text dates from the Ur III period or even later, and was therefore written as late as 150 years after the Akkadian Empire was destroyed (Cooper 1983: 11-12).

No matter when it was written, a more serious problem with employing the Curse of Agade as a primary source is that it is clearly not an accurate representation of historical events. Among other things, the legend revises the political history of the Akkadian Empire. For while the Curse of Agade casts the fourth Akkadian ruler, Naram-Sin, in the role of the villain directly responsible for the collapse of the Akkadian state, there is ample evidence to indicate that Naram-Sin's son, Šarkališarri, reigned after him for at least two decades. Indeed, many scholars believe the legend is an anti-Akkadian (or perhaps specifically an anti-Naram-Sin) polemic, and is therefore not so much a historical document as it is a political one (Cooper 1983: 9). Thus,

because the historicity of this text is uncertain, at best, its utility as evidence of the social impacts of the 4.2 ka event is also questionable.

What is perhaps the most serious weakness of the 4.2 ka hypothesis, however, is the heavy reliance of this model upon paleoclimate proxy data obtained from a very small number of sites in northeastern Syria that are spaced no more than 50 km apart (Weiss *et al.*, 1993: 1000), which are employed as the basis for describing the processes and impacts of climate change across a vast area marked by numerous geographical and cultural differences. Specifically, evidence for drought from three sites in the eastern Khabur Basin, and particularly from the large urban center of Tell Leilan, has been frequently used by proponents of the 4.2 ka hypothesis as a bellwether for the onset of increased aridity across the entirety of the Tigris-Euphrates drainage basin (e.g., Weiss *et al.*, 1993; Cullen *et al.*, 2000; Weiss 2000; deMenocal 2001; Staubwasser and Weiss 2006).

Although the Khabur data are then coupled with a wide array of other evidence to demonstrate the existence of a global climate change event c. 2200 BC, such as Greenland ice core data (Weiss *et al.*, 1993: 1001-02), cave speleothems from the southern Levant (Weiss 2000), or marine sediment cores from the Arabian Sea (Cullen *et al.*, 2000), it is still the case that defenders of this hypothesis have largely overlooked the fact that the effects of regional climate events are often highly variable at higher geographical resolutions. Microclimate variability is certainly known in the Near East, where differences in terrain, latitude, continentality, and other factors have resulted in a considerable diversity of local microclimates, even within relatively small

areas (Riehl *et al.*, 2009: 155). Indeed, as Weiss has himself noted, even the Khabur region is “characterized by rather steep isohyet gradients which make generalization from one locus a difficult matter” (Weiss 1983: 40).

Moreover, although supporters of the hypothesis have utilized proxy data from around the globe in order to extrapolate what climatic conditions were like in Mesopotamia at the time, comparatively little is known about *local* conditions in the vicinity of many settlements that were abandoned in the final centuries of the Early Bronze Age. The lack of information about Early Bronze Age Mesopotamian microclimates, coupled with the high variability in local conditions that is exhibited in the Near East today, means that broad characterizations of regional Near Eastern climate based almost entirely on the extrapolation of data from two or three Khabur sites are largely meaningless, and by extension, the conclusion that the wave of urban collapse spread across Mesopotamia occurred as entirely a result of drought cannot be adequately supported by the available evidence. If we are to truly delve into the matter, it is necessary to first obtain a much greater corpus of paleoclimatic proxy data from multiple parts of the Upper Mesopotamian region, so that the assessment of the potential impacts of climate change upon its Early Bronze Age polities will address the problem of microclimatic variation to a satisfactory degree.

In light of the critiques discussed above, it is clear that while the 4.2 ka hypothesis has raised an important issue in the study of Early Bronze Age Mesopotamia, and provided a testable working hypothesis to explain the phenomenon of urban collapse events that took place in this region at the end of the 3rd millennium,

the explanation of collapse provided by the model is deeply flawed. I contend that if we are to develop more nuanced models that can adequately explain the causes of this development – including climate change – it is necessary to shift our focus away from monocausal explanatory models like the 4.2 ka hypothesis and to instead delve into the complex, multiple causation of these events. This study has been consciously designed with this goal in mind, and it is offered here with the hope that it will serve as an instructive example of the utility of this multicausal approach to the study of Early Bronze Age collapse in northern Mesopotamia.

1.2: The Present Study

Up to now, I have discussed the phenomenon of late 3rd millennium collapse in northern Mesopotamia primarily in regional terms. However, this study will not attempt to provide an explanatory model that would cover the whole of Upper Mesopotamia. Rather, my object here is more limited: to establish a multicausal model for the collapse of Titriş Höyük, the dominant urban center in the Karababa Basin of southeastern Anatolia, which, like many other cities in northern Mesopotamia, was virtually abandoned at the end of the 3rd millennium BC.

In this paper, the political collapse of Titriş Höyük will be conceived of as a Sewellian “historical event.” For Sewell (e.g., Sewell 2005), an “event” is a tipping point in history that results in a permanent alteration of social structures or practices, and which has multiple causes that can only be fully understood by first understanding how they interrelate with each other. (This concept will be discussed in detail in

Chapter 2). Consequently, I will weave together the available archaeological, historical, and paleoclimatic proxy evidence here to develop an explanation for the disintegration of Tiriş that emphasizes the articulation of a number of critical factors as the principal reason for the failure of the city-state.

Given the centrality of climate change in many current archaeological explanations of societal collapse in Early Bronze Age northern Mesopotamia, a key component of this project is to establish whether there is any local paleoclimatic proxy evidence of an abrupt change in local climatic conditions within the Karababa Basin during the late 3rd millennium BC that could have impacted the city of Tiriş Höyük. In order to achieve this goal, I will employ a technique that is more or less novel in the archaeology of Bronze Age Mesopotamia: stable isotope analysis. By analyzing the stable carbon, nitrogen, and oxygen isotopes of archaeological samples of human bone and faunal tooth enamel from Tiriş and other sites in the study area – a technique that, while underutilized in Mesopotamian archaeology, has proven highly successful in other Old World contexts (e.g., Sharma *et al.*, 2004; Hallin *et al.*, 2012) – this project will provide new knowledge concerning paleoclimatic conditions in the vicinity of Tiriş throughout its Early Bronze Age occupation. This body of paleoclimate proxy data will allow for important inferences to be made about the climate history of the Karababa Basin, and in conjunction with the existing local archaeological record, can be employed to determine if and how climate change influenced the downward trajectory of Tiriş Höyük during the late 3rd millennium.

There are several reasons why I have chosen to focus on a single polity and its

catchment basin hinterland, rather than seeking to develop a sweeping model for the entire region. To begin with, although the 4.2 ka hypothesis tends to speak of the “regional collapse” in monolithic terms, the reality is that although many urban polities did fail during the tumultuous final centuries of the 3rd millennium, the unique circumstances of each site context tell against a simplistic, monocausal explanation. It is clear from the archaeological evidence that not every polity in the region disintegrated during this time (as will be discussed in more detail in Chapter 4). Even among those that did, the timing and circumstances of these individual collapse events were not uniform, and in many cases, there are good grounds to suppose that the causality of the collapse is complex. Another reason why I am focusing on a single city-state is that regionally-based approaches to the study of collapse – for example, the 4.2 ka hypothesis – often tend to overemphasize the role of climate, and overgeneralize when dealing with the archaeological evidence (cf. Tainter 2006; Butzer 2012). A multicausal approach, on the other hand, approach equally balances both the archaeological and the paleoclimatic evidence. Finally, by dealing with a single site, it becomes easier to contextualize paleoclimatic proxy data within the specific archaeological context, and thus to understand how any climatic influences upon the developmental trajectory of the polity in question articulated with other crucial factors that are attested in the archaeological record.

Why, given the plethora of sites in the Syrian *jazira* that also experienced political collapse during this period, have I chosen to focus my attention solely upon this relatively peripheral polity? A number of criteria were considered in the decision

to make the Titriş Höyük the focus of this investigation. First and foremost, Titriş Höyük was abandoned at approximately the same time as many other cities in northern Mesopotamia, including the aforementioned Tell Leilan. Similarities in local climate were also a consideration: for example, mean annual precipitation in the Karababa area (c. 400-470 mm/year; cf. Wilkinson 1994: 484) is similar to that reported by Weiss for Leilan in the Khabur (450 mm/year; cf. Weiss 1983: 40). Thirdly, the excavations of Titriş Höyük have provided an unusually rich body of archaeological data, particularly with respect to osteological materials. Moreover, because materials from other, smaller Karababa Basin sites that were contemporaries (and probably satellites) of Titriş Höyük were also readily available for analysis, it was therefore possible to investigate the 3rd millennium climate history not only of the city itself and its immediate vicinity, but also of other, smaller contemporary sites located in the study region. And finally, this particular site was chosen in part because the historical process leading up to its abandonment has not been exhaustively discussed in the archaeological literature. On the contrary, there are still many unanswered questions pertaining to the collapse of Titriş Höyük that up to now have not been fully explored. Although it was not possible to address all of those outstanding issues in the present study, it is my hope that the model proposed in this paper will nevertheless constitute a significant contribution in that direction.

1.3: The Organization of this Dissertation

Before moving further, I shall pause here to briefly explain the organization of

the chapters that follow. There are a total of 11 chapters present in this dissertation. This chapter and Chapter 2 together comprise a general introduction to the research question and the regional setting. Chapter 3 will discuss the history and complexity of archaeological theory as it relates to collapse, while Chapters 4, 5, and 6 will delve into various aspects of the archaeological evidence that is germane to the matter under investigation. Thereafter, in Chapter 7, I will briefly move away from archaeological matters to introduce the basic principles of stable isotope analysis. Chapters 8 and 9 will present a variety of paleoclimate proxy records from the Near East, the Eastern Mediterranean Basin, and Northeast Africa, in order to provide regional context for the stable isotope proxy data generated in this study. The latter will then be presented in Chapter 10, along with my interpretation of the data and their archaeological implications. Finally, Chapter 11 will present the multicausal model itself, compare this model with the 4.2 ka hypothesis, and finally, consider some outstanding questions about the collapse of Titriş Höyük that will need to be resolved by future research.

Chapter 2: Theoretical Approaches to the Archaeological Study of Collapse

I will begin this chapter with a brief exposition concerning what the term “collapse” means in archaeological parlance and explain the definitions for collapse terminology that will be employed in this study. This will be followed by a short review of the history of archaeological thought about collapse, as well as some of the major non-archaeological influences upon it. Thereafter, I will turn to consider some of the problems with “traditional” archaeological ideas about collapse that have been the subject of debates in the literature, and also critiques of environmentally-based explanations for collapse. Finally, I will enumerate a theoretical stance, based on the work of historian-sociologist William H. Sewell, which I believe represents a viable way of avoiding some of those problems, and which forms the theoretical underpinnings of the multicausal collapse model I will present in Chapter 11.

2.1: Archaeological Conceptions of Collapse

2.1.1: What is collapse? Archaeologists conceptualize collapse in a myriad of different ways. (Just as importantly, for that matter, there is also a range of views concerning what collapse *isn't*.) While a full and comprehensive treatment of the various definitions of collapse employed in archaeology is beyond the scope of this chapter, it is nevertheless instructive to examine how collapse is conceived of through the examination of a number of illustrative examples.

Before moving to examine how the term “collapse” is specifically employed in the archaeological literature, it is useful to first consider the broader everyday meanings of the word. For a start, it seems fair to say that the word is usually employed to evoke a sudden and dramatic event characterized by catastrophic structural failure. However, as Joseph Tainter (2006: 60) aptly notes, even in vernacular usage, collapse can refer to “everything from what happened to the Soviet Union to what a worker may do at the end of a hard day.” Whether the cause(s) of this catastrophe were internal or external is of no consequence – the word can be applied equally well in either case. The word also typically refers to the moment in time during which the catastrophic failure took place. Confusingly, however, the term can also be used as a verb to describe the gradual process which led up to the sudden failure, as in comedian Eddie Izzard’s famous quip about the Austro-Hungarian Empire: “all it did was slowly collapse, like a flan in a cupboard.”

To explore the ambiguity that is inherent in the definition of the word “collapse”, let us now consider a simple metaphorical example: the collapse of a long-neglected house. For a start, the word seemingly implies that the dwelling has undergone a severe structural failure – it wouldn’t be appropriate to call this failure a collapse if the extent of the damage was simply a few shingles falling from the building’s roof! Beyond this point, however, when the house in question is considered to have reached a state of collapse is contextually dependent. For example, the word “collapse” could be used to refer to the moment in which the house actually caved in (i.e., “I was standing only ten feet away from the house when it collapsed”), or to refer

to the entire process by which it slowly decayed and eventually fell down (i.e., “the house had been slowly collapsing over a five-year period.”). Moreover, the factors that caused the house to collapse are not inherently obvious from the word itself; it could have fallen apart on its own or been brought down by a wrecking ball, and in either case the word would still be appropriate.

It is clear from the discussion above that the vernacular meanings of the word “collapse” leave a lot to be desired. For this reason, and to avoid creating unnecessary confusion, I will provide my own definitions for collapse here. First, however, I wish to say a few words about the terminological distinctions I will employ in this study to separate the *process* of collapse from specific *instances* of collapse. When discussing societal collapse as a generalizable process, I will simply say “collapse” (as in, “the study of collapse”), or, if I wish to emphasize that I am discussing the general process, I may instead use the term “collapse-as-process.” I will refer to specific *instances* of societal collapse, on the other hand, in one of two ways: when speaking of individual societal collapse events in the abstract, I will refer to them as “collapse event(s)”; if I am discussing a particular historical case, I will reference the polity in question directly in the text (e.g., “the political collapse of Tiritiş Höyük”).

Having said that, in this study, the term will always be used to refer to the political disintegration of a particular social system – i.e., a specific polity, institution, trade network, etc. This meaning of “collapse” will be the same regardless of whether I am discussing the process of collapse or specific collapse events. However, for reasons that will be discussed below in Section 2.3, I will *not* use the term to describe

the total disappearance of an entire cultural system, ethnolinguistic groups, civilizations, etc.

2.2: Tracing the Historical Development of Archaeological Theories of Collapse

Almost from the start of recorded history, scholars and laymen alike have sought to understand how and why some complex societies “failed”. When viewed from the *longue durée*, it is not difficult to see how archaeologies of collapse are mirrors, in a sense, of the academic *zeitgeist* of the period during which they were in vogue. As we shall see, the ebb and flow of cultural attitudes and predilections left telling marks on the archaeological study of collapse, and played a significant role in shaping the set of ideas about collapse that are employed in the present.

Before I begin, however, it is as well to say a few words about the history that follows. First and foremost, this is not a comprehensive review of the historical development of social theory concerning collapse – not only is such an undertaking far beyond the scope of this limited review, but excellent discussions concerning the history of collapse thinking, as well as that of the vicissitudes of archaeological theory in general over the past two centuries, are already available elsewhere (e.g., Tainter 1988; Trigger 2006). Rather, my object is to highlight a number of theoretical stances about societal collapse that are of particular relevance to the present study. For this reason, the discussion that follows will focus largely upon schools of thought which 1) do not explicitly reject the concept of collapse; 2) actively engage with the notion of collapse-as-process, as well as collapse-as-event; and 3) assume that collapse events

can be understood in terms of a specific underlying causal factor or a complex of causal factors.

2.2.1: Historical particularism in early modern historiography. In his 1988 book, *The Collapse of Complex Societies*, Joseph Tainter notes that discussions of ancient societal collapses prior to the 20th century were mostly confined to the explanation of the decline and disintegration of “specific *political* entities” (Tainter 1988: 39). The focus of early historians and antiquarians was the identification and description of the arc of a given civilization’s history; the specific events that caused a society to fall apart were only of interest, therefore, as a part of this larger historical narrative.³ Studies of this period were far less concerned with generalizing about the *process* of collapse, but rather, in directing their attention towards the historical trajectories of individual states or empires.

The quintessential example of this tendency is Gibbon’s *Decline and Fall of the Roman Empire* (1776-88). Although this book might at first seem to be a prototype for the study of collapse, its aims were limited entirely to the elaboration of the unique and historically-contingent causes for the collapse of the Western Roman Empire, which ultimately culminated in the Western Empire being overrun by Germanic “barbarians” in the late 5th century. In Gibbon’s view, the ultimate causes of this calamitous event were the gradual erosion of Roman civic spirit, a diminishing emphasis on military service, the triumph of “Oriental decadence” over Roman virtue,

³ One notable exception to this was the famous 14th century Andalusian historian, Ibn Khaldun, who did attempt to articulate a more general explanation for the rise and fall of human societies (cf. Abun-Nasr 1987: 17; also the discussion in Pennell 2003: 76-77).

and the adoption of Christianity. With its focus on the political decline of a single complex polity, and on the historically-rooted causes of that decline, Gibbon's work serves to illustrate this early particularistic perspective on collapse.

2.2.2: The influences of enlightenment and post-enlightenment philosophy and social theory. In stark contrast to the historical particularism described above, many of the social, economic, and political thinkers of this period sought to “scientifically” understand the developmental trajectories of societies, and the factors that influenced these trajectories, as part of a larger effort to achieve the betterment of humanity. Many Enlightenment thinkers, such as the aristocratic French social theorist, Jean-Antoine Nicolas de Caritat (who is usually referred to by his title, the Marquis de Condorcet) believed that “the empirical gathering of data was the first step towards a society that could progressively free itself from poverty, ignorance and pain” (Schama 1989: 186). It should not come as a surprise, therefore, that the late 18th century was the time when social science began to come into its own.

A key goal for many of the Enlightenment-era thinkers who embraced this new social science was “to trace the connections between population, economy, and environment” (Mayhew 2014: 19). The Marquis de Condorcet, for instance, believed that the collection of demographic and socioeconomic data was essential to the development of political reforms – a philosophy that he attempted to put into practice after being elected into the Legislative Assembly of Revolutionary France in 1791 (cf. Mayhew 2014: 37-41).

But perhaps the most famous example of this effort is Thomas Robert Malthus' highly influential – not to mention highly controversial – tract, *An Essay on the Principle of Population* (1798). For Malthus, the question of a society's well-being could ultimately be pared down to a simple ratio: the relative increase of subsistence versus that of population. This ratio, Malthus argues, is not “naturally” equal: “Population, when unchecked, increases in a geometrical ratio [while] Subsistence increases only in an arithmetical ratio” (1798: 13). Given the disequilibrium between population growth and resource availability, he argued, without some sort of checks upon the increase of population to keep the differences in the ratio between it and the development of subsistence relatively small, societies would inevitably outstrip their agricultural capacity, resulting in what he chose to call “severe distress” (Malthus 1993 [1798]: 19).

Malthus' essay has been controversial since its publication in 1798, when it was almost immediately attacked by contemporaries, such as the political economist David Ricardo, for being both excessively pessimistic and too focused on the short-term effects of change (cf. Winch 2013: 79-95). But the premise that overpopulation can result in destabilization or decline has nevertheless retained a strong influence upon later archaeological theories of societal collapse. Indeed, as we will see, undercurrents of Malthusian logic can be identified in several later schools of social and archaeological thought about the collapse of complex societies.

Although Malthus never actually uses this terminology, his essay is arguably the first attempt by a “modern” social scientist to systematically study the *general*

process of societal collapse. For while the arguments that he puts forward in *An Essay on the Principle of Population* were intended for an audience of European intellectuals, the idea that population growth leads to poverty, disease, and so on is presented in terms of the whole arc of human societies up to the late 18th century. While the “evidence” he cites is frequently questionable (or in some cases non-existent), particularly in his discussions concerning population growth and limits among “primitive” societies, it is clear that the intent of Malthus’ essay was to enumerate a problem that the author saw as universal to humanity. Moreover, as we shall see, the Malthusian position on overpopulation and resource scarcity has enjoyed something of a revival since the 1960s, and is highly influential in many contemporary theoretical stances concerning societal collapse.

2.2.3: Conceptions of collapse in the late 19th century. Thanks partly to the work of Malthus and his contemporaries at the end of the 18th and beginning of the 19th century, by the latter half of the 19th century, a more “processual” approach to understanding civilizational dynamics had emerged in the social sciences. While social scientists and other thinkers of the period were very much interested in unraveling the complex skein of human behavior at a basic level, their work tended to focus on the *rise* of civilization, as opposed to studying how or why civilizations fail.

However, the work of early anthropologists like Henry Lewis Morgan, and especially Charles Darwin’s Theory of Evolution, were also major influences upon the work radical theorists, particularly Friedrich Engels (cf. Patterson 2009). Indeed, with the possible exception of Darwin’s Theory of Evolution itself, few if any of the

theories about human societal development that emerged during this period have held more influence over the intellectual view of societal collapse in subsequent eras than the writings of Karl Marx and Frederick Engels. The influence of Darwin's ideas about evolutionary change upon the work of Engels (and thus of Marx), for example, can be readily seen in the Marxist historical progression of hierarchical systems of human social organization, which, beginning with so-called "Asiatic mode of production," advances through a series of linear stages towards late industrial capitalism. As we shall see, both the Marxist paradigm and the evolutionary theories that influenced it would leave a deep imprint upon later archaeological scholarship; in archaeology, they would be a key influence on the development of processual archaeology in the 1950s.

2.2.4: Societal collapse in postwar 20th century archaeological thought: processualism and postprocessualism. It was not until after World War I, and especially in the decades immediately following World War II, that an increasing emphasis on exploring the processes leading to societal collapse started to emerge in studies of culture change. Scholars from this post-war period (e.g., Fried 1967; Service 1962; Steward 1955) typically conceptualized these phenomena in terms of global evolutionary processes, which, while acting on individual societies, operated as a series of universal regularities that operated independently of their immediate cultural context (cf., for example, Binford 1968b). As a result, the core of this so-called "processual" paradigm was a belief that the characteristics and evolution of all

human social structures could be scientifically studied and described in a manner not unlike that of physical sciences (cf. Hodder 1982).

As the processual school was primarily interested in identifying the “laws” that they believed governed the process of human social evolution, processual archaeologists naturally also sought to develop general explanations for how and why societies fail. Tainter (1988: 42) has boiled these many explanations down into the following eleven categories:

1. Depletion or cessation of a vital resource or resources on which the society depends.
2. The establishment of a new resource base.
3. The occurrence of some insurmountable catastrophe.
4. Insufficient response to circumstances.
5. Other complex societies.
6. Intruders.
7. Class conflict, societal contradictions, elite mismanagement or misbehavior.
8. Social dysfunction.
9. Mystical factors.
10. Chance concatenation of events.
11. Economic factors.

A “classical” example of processualist theory about the universal causes of societal collapse is that advanced by the anthropologist Julian Steward. Steward draws on Malthusian logic to argue that the process of societal collapse results from a combination of two causes: overpopulation and the overexploitation of natural resources (1955). For Steward, as societies grow and begin to consume more and more resources, they ultimately overtax their environment, leading to catastrophic economic consequences that precipitate societal failure.

Apart from Steward, the influence of Malthus can also be seen in the work of other processual archaeologists of this period. Meggers, for example, also channels Malthus in arguing that unless some other clear-cut cause can be identified, archaeologists should generally look to “the possibility of decline in the subsistence resources” as the first resort in developing models for societal collapse (1960: 311).

While Steward points to economic mismanagement of resources as the primary root cause of societal collapses, others prefer to ascribe the ultimate cause of societal failure to the “maladaptive” organizational structure of social and political institutions. A good example of this view of collapse can be found in the work of Kent Flannery (1972) and Roy Rappaport (1977), who contend that societies fail because of what they term “institutional hypercoherence”. Flannery (1972: 409-411) argues that if various social or environmental stresses cause the local institutions (which he terms “lower-order” institutions) that support a given social system become excessively interdependent upon the central bureaucracy (what he calls “higher-order” institutions), the latter become rigid, and lose their flexibility to deal with stress. As a

result, when the system is faced with a serious shock, the state can become destabilized and collapse unless it develops a new regulatory system for its maintenance that is better adapted to new conditions.

Beginning in the mid-to-late 1970s, there appeared a growing dissatisfaction with the processual tendency to reduce complex and idiosyncratic cultural behaviors into generalized laws, which by the 1980s had coalesced into the “postprocessual” theoretical school. Although postprocessualism is usually seen as the brainchild of Ian Hodder and the so-called “Cambridge School”, it was also part of a larger academic reorientation towards postmodernism and critical theory during this period. Drawing inspiration from the postmodernist philosophical writings of Foucault, Derrida, and others, a key part of the postprocessual paradigm was the identification, deconstruction, and critique of cultural and intellectual biases and assumptions that underpinned the processualist school of archaeological theory (e.g., Hodder 1991; Knapp 1996).

For postprocessual archaeologists, this drive resulted in a wide-ranging critique of the processual paradigm and a search for alternatives to it. It is not surprising, then, given that the study of societal collapse as a generalizable process was a part of the larger processual desire to identify universal processes of human social evolution, that few postprocessual archaeologists actively engaged with collapse as a general process. While the study of collapse as a general process advanced considerably under the processualist paradigm, postprocessualists argued that the processual approach was fraught with problematic approaches and assumptions. One of the most glaring,

according to Ian Hodder (1982: 3-4), was that the functionalist basis of the processual paradigm had resulted in the creation of a false dichotomy between “adaptive utility” and “culture”. In other words, the processual belief in the universality of human social structures and social evolution had caused processualists to underemphasize the importance of the unique cultural contexts in which they found their data.

As Hodder explains, far from seeking to identify and explain universal laws of human social evolution, postprocessualists sought to follow in the footsteps of earlier historical archaeologists who “were concerned primarily with the nature of culture and cultural contexts” (1982: 11). Consequently, there was virtually no theoretical engagement with the study of the process of collapse in postprocessual archaeology. Indeed, the postprocessual focus on seeking to interpret the past through the analysis of symbolic meaning among ancient peoples (e.g., Hodder 1987) or via a phenomenological lens (e.g., Tilley 1994), and the emphasis on the uniqueness of individual cultural contexts and perspectives, meant that the study of collapse as a general process would, at best, constitute a largely pointless exercise.

2.2.5: Contemporary archaeological theories of collapse: the rise of environmentally-based explanatory models. In the past twenty-five years, there has been a resurgence of interest in studying the processes that shaped ancient societal collapses. Moreover, a great deal of attention is now being paid to the potential role of environmental change as a cause of ancient collapse events. This idea is certainly not new, of course; this notion has its roots in the work of Steward, and because of the connection between overpopulation and resource mismanagement, even that of

Malthus to some extent. But the idea that environmental degradation or climate change had disastrous consequences for ancient peoples has become increasingly central during the past thirty years, both in academic literature and popular media.

The current upwelling of interest in the role of climatic and/or environmental change as a cause of collapse has been spurred by numerous factors. Of these, I would argue that three, in particular, have been especially influential. The first of these is the wealth of new and increasingly precise paleoclimatic proxy data about conditions in the ancient past that has emerged in recent decades (see Chapters 8 and 9) -- itself an artifact, in large part, to the ongoing development of increasingly powerful, sophisticated, and easily accessible technological means to obtain this information. The second is the influx of a number of concepts and theories from ecology, such as resilience theory, into contemporary archaeological theory (e.g., van der Leeuw and Redman 2002; Redman and Kinzig 2003; Redman 2005; Scarborough 2009; Weiberg 2012). But perhaps more than anything else, it is the mounting concern among scientists about anthropogenic climate change and its impacts upon contemporary human societies that has left the deepest imprint upon this particular avenue of archaeological research. From even the brief and incomplete sketch of the history of archaeological thinking about societal collapse described above, this should come as no surprise; contemporary world events, and the academic *zeitgeist* of the time, have always exerted a strong influence upon the archaeological theory of a particular period.

2.2.5.1: Socio-natural studies and resilience theory. Although environmentally-constituted explanations for instances of collapse are legion in archaeological literature these days, most of these limit themselves to individual, historically-contingent cases, rather than seeking to explicate the mechanisms for collapse as a general process. However, since the late 1990s, a small but growing number of archaeologists who seek to understand the impacts of environment and environmental change upon ancient peoples have begun to formulate a new theoretical approach to the study of societal collapse that draws heavily upon ecological theory. Adherents of this new school of archaeological theory, which is sometimes called “socio-natural studies” by its adherents, seek to “develop a trans-disciplinary approach to environmental problems which does away with the presumed differences between ‘cultural’ and ‘natural’ processes” (van der Leeuw and Aschan-Leygonie 2000: 2), and to “stimulate further discussion on promoting archaeological involvement in transdisciplinary research addressing environmental issues” (van der Leeuw and Redman 2002: 597). The object of this theoretical school, then, is to plumb the frequently murky depths of human-environmental relations in the past, in order to identify and understand the underlying processes that drive both social and natural change.

Archaeologists who ground their research with this theoretical stance believe that an understanding of human-environmental relations can only be truly achieved through the study of coupled “socio-natural” (or “socio-ecological”) systems. What, then, are socio-natural systems? When pared down to a basic level, the concept of a

socio-natural system is deceptively simple. Holling (2001: 390-391) explains the basic assumptions behind the concept thusly: 1) natural and social systems are both complex adaptive systems; 2) the “complexity of living systems of people and nature emerges not from a random association of a large number of interacting factors [but] rather from a smaller number of controlling processes”; and 3) “there is a requisite level of simplicity behind the complexity that, if identified, can lead to an understanding [of complex adaptive systems] that is rigorously developed but can be communicated lucidly.” In other words, because ecosystems and human societies are both complex adaptive systems⁴, and because complex systems continually adapt and evolve (*ibid*: 391, 393-396), it is therefore possible to develop empirical models that can be used to understand the abstract processes that cause both ecological and social change more or less interchangeably.

As is befitting of its stated trans-disciplinary ethos, the socio-natural studies approach to the study of social change borrows heavily from the ideas and perspectives of other scientific fields, particularly ecology. This influence is most visibly manifested in the archaeological adoption of resilience theory. At the core of resilience theory is a process that Holling calls the “adaptive cycle” (2001: 393-396). This idea is usually conceived of in visual terms, and is represented as a figure-eight shape (see Figure 2-1). The adaptive cycle is best understood as two connected “loops”. The first one, the so-called “front loop,” consists of two phases – exploitation and conservation – that represent the growth and subsequent stagnation of a given

⁴ Holling does note, however, that human systems do exhibit some unique features that are not found in other systems (cf. 2001: 401-402).

complex system, while the so-called “back loop” involved two stages known as release and reorganization (cf. the discussion in Weiberg 2012: 153- 155).

Let us now consider each of these phases, as they are defined by Holling (cf. 2001: 394; also the discussion in Weiberg 2012). The “exploitation” phase is rather straightforward: simply, this phase involves the accumulation of economic, political, social, or ecological “capital” within the system, thus allowing the system to grow. The “conservation” phase, on the other hand, is defined by Holling as the attempt to keep the system stable once it reached a point where further growth is either slowed considerably or is no longer possible (as opposed to a conscious attempt to conserve resources).⁵ Eventually, however, the efforts to conserve the system cause it to become excessively rigid and overconnected, and it subsequently breaks down – a process that Holling refers to as the “release” phase of the adaptive cycle, because the disruption of the system results in a major release of energy (or capital) that had been accumulated during the first two phases. Finally, after the system fails in the release phase, its surviving constituent parts re-form during the “reorganization” phase, transforming into a new system that begins to accumulate the energy that was released in the breakdown of the previous one.

2.2.5.2: Resilience theory in archaeological models of collapse. Resilience theory and some of its key concepts are valuable for archaeologists in a number of

⁵ Thus, counterintuitive though it may seem, the contemporary political efforts being made by entrenched economic interests to resist a shift away from economic overdependence on fossil fuels is actually an example of “conservation” in Holling’s definition, as the purpose of this effort is to maintain the stability of the prevailing economic and political status quo.

ways. One reason for this is that they provide a useful heuristic model for reconceptualizing archaeological problems. As Weiberg points out, for instance, employing the term “release” instead of “collapse” to describe the sudden disintegration of a polity or social system is an effective way to sidestep the problematic connotations of the latter term, and thus to highlight the transformative and resilient aspects of the phenomenon in question rather than primarily focusing on destructive ones (Weiberg 2012: 158).

Another reason is that these key terms are accessible to scholars in other disciplines, particularly ecology and other related earth sciences. This means that the use of the models and language of resilience theory constitutes a ready-made means to “translate” archaeological findings into more digestible terms for those specialists. Thus, resilience theory may help to narrow the gaps between these fields, and help to facilitate future transdisciplinary research (cf. Izdebski *et al.*, forthcoming).

However, while resilience theory is useful as a heuristic model for conceptualizing collapse, it does have its shortcomings. In particular, resilience theory is a top-down, systems-based perspective of collapse. Like so many other abstract, generalizable models of social behavior, it cannot consistently predict the often-irrational actions of individuals. So while resilience theory seeks primarily to explain the causes of change in complex systems, human societies can be profoundly influenced by individual actions or other ephemeral phenomena, and resilience theory does not have a particularly robust means of dealing with this fact.

2.3: Problems with Archaeological Conceptions of Collapse

By now, it should be readily apparent to the reader that the term “collapse” in archaeology is problematic, at best. For one thing, the lack of terminological consensus about what “collapse” is and isn’t has resulted in considerable confusion. Indeed, some archaeologists have questioned whether the word should be dropped altogether because of its multiple loaded and ambiguous meanings (e.g., McAnany and Yoffee 2010).

The need to develop parsimonious explanations for the causes of collapse-as-process or specific collapse events has added to this confusion. Developing abstract categorical explanations for collapse may be useful as a means to grapple with the complexities of the archaeological data, but it can also be highly problematic. A particular flaw in this approach is that invites *a priori* subjective judgments about historical circumstances that are difficult to measure or verify. If we look at Tainter’s eleven categories of causal factors, for example, how do we identify an “insurmountable” catastrophe? And by what means are we to assess its relative “insurmountability” in comparison to other disruptive events or processes? How does one measure what constitutes an “insufficient response to circumstances,” and what makes a response “insufficient?” Or, for that matter, what set of circumstances would qualify as a “chance concatenation of events,” and how do we determine that such an occurrence was brought about by chance, rather than as a result of the articulation of other embedded causal factors?

Relying upon these generalized, abstract categories to explain collapse events also tends to lead to reductionist interpretations of the evidence that all too often shoehorn complicated and interrelated processes and structures into arbitrarily constructed categories. To illustrate why this is problematic, I will now briefly examine a more recent historical example: the French Revolution.

It has long been established that a prolonged financial crisis was a critical causal factor for the French Revolution (e.g., Schama 1989: 60-71). However, it is impossible to disentangle the economic woes of Bourbon France during the 1780s from the French military support of the American colonies against Great Britain during the Revolutionary War – and the French support of the American Revolution, in turn, cannot be understood separately from France’s long-standing economic and political rivalry with England, which itself has its origins embedded in the Norman Conquest of England in 1066. Thus, while it is not technically incorrect to say that “economic factors” precipitated the fall of the Bourbon monarchy, such a claim would mask the roles of France’s long-standing political rivalry with Great Britain, the wider European geopolitical situation of the late 18th century, or even the internal structural and political problems embedded within the British colonial taxation system of the mid-18th century, all of which played roles in shaping the French economic plight of the 1780s, and, by extension, the momentous chain of events that occurred in France beginning in 1789.

This point is of particular importance, and bears further elaboration. Whereas there is ample historical information from which to draw such connections in the case

of many historical instances of collapse – for example, a wealth of documents that outline the economic problems faced by the Stuart monarchy in England prior to its collapse in 1649 and the Bourbon French *ancien régime* in 1789, which facilitates comparison of the particular economic circumstances in each case – in the majority of archaeological cases we do not possess a sufficiently detailed or chronologically precise record with which to establish the multiplicity and interrelationship of various causal factors.

The French Revolution is, of course, a well-documented historical case for which we possess a substantial body of texts and other primary sources, and are thus able to say a great deal about the economic, social, political, and ideological circumstances. But in those archaeological cases where we lack sufficient historical information to provide detailed context of an instance of societal collapse, focusing our discussions about the causes of this happening in terms of broad, abstract categories is an appealing solution, because it allows us to fill in the many gaps through analogies with other cases where the record is better defined. However, because these analogous cases have their own distinct and unique historical circumstances which do not apply, this process can encourage a reductionist approach to the study of collapse which overemphasizes structural or processual similarities that are shared between various instances of collapse at the expense of unique historical circumstances which do not map well from one to the next.

Another problem facing archaeologists who seek to develop explanatory models for collapse or specific collapse events is scale. For example, if one views the

collapse of Early Bronze Age polities in northern Mesopotamia from a regional perspective, it is all too easy to seek to explain the rash of collapse events in this region in terms of a single, unitary cause – such as the fall of the Akkadian Empire, or the onset of a dry period brought on by climate change – that is not always supported by the archaeological evidence. So problematic is the issue of scale that McAnany and Yoffee have declared that “studying collapse is like viewing a low-resolution digital photograph: it’s fine when small, compact, and viewed at a distance but dissolves into disconnected parts when examined up close” (2010: 5).

Yet another problem that has long been bemoaned in discussions about theoretical approaches to collapse is the tendency of some archaeologists to overstate the extent and effects of collapse events. One reason for this is that there is a long tradition of viewing the “rise” and “fall” of a given society as being somehow analogous to the life cycles of living organisms (e.g., Spengler 1923). As Adams has convincingly argued, however, “there is, simply, no justification for teleological or vitalistic constructs” in the archaeological study of how ancient civilizations developed and collapsed, as the cultural practices, norms, and ideas of a society are rarely (if ever) totally extinguished as a result of its political collapse (1988: 21). Indeed, it is almost always the case that at least some of the structural characteristics and cultural traditions found within a given social system manage to survive its political disintegration, albeit often in a somewhat different form (e.g., Weiberg 2012: 158).

A final problem with many archaeological approaches to collapse – and in particular, with many processualist/neo-processualist models – is that they are often tinged with a kind of fatalism: the assumption that the roots of a given society's political collapse can generally be found in its own structural weaknesses or maladaptive behaviors. The pre-eminence of maladaptive structural characteristics is clearly evident, for example, in the institutional hypercoherence models of Flannery and Rappaport. The latter tendency of assuming that maladaptive cultural or economic practices are the primary cause of collapse, which derives partly from the arguments made by Malthus, is explicitly put forward in Steward's model, which pegs human overexploitation of resources as the primary cause of societal collapse.

There are two primary problems with these fatalistic assumptions. The first is that in most cases, the archaeological or historical evidence does not point towards simplistic explanations for collapse, but rather towards a complex of multiple factors that can only be properly understood when placed into a larger historical context (e.g., Schneider and Adalı 2014). The second problem with this fatalistic conception of collapse is that it masks the resilience of many institutions, practices, and traditions that survive collapse events, albeit often in modified forms (cf. Weiberg 2012: 151-152). In short, if we view collapses as "inevitable," we fail to appreciate both the complexity of their causality and the resilience of numerous aspects of the "failed" social system in question, and we also fail to appreciate the importance of timing in the development of specific instances of collapse.

2.3.1: Critiques of contemporary environmentally-based explanations for collapse. As the prominence of environmentally-based explanations for collapse events – both in the archaeological literature and public media – has increased, the critique of these models has also become more visible. Coombes and Barber, for example, arguing from a neo-postprocessual perspective that is highly suspicious of environmentally-driven collapse models, have rejected this rapidly-growing body of work as a resort to what they deem “‘black box’ environmental determinism” (2005: 304). Even among archaeologists who have taken up a less hostile attitude towards the socio-natural studies approach, there is discomfort with the apparent tendency of this school of thought to resort to “correlation-implies-causation” arguments that oversimplify the complexities of collapse events. Many – myself included – feel that socioecological models tend to focus excessively on developments at a macro scale, and thus tend to overemphasize large-scale processes, like climate change or maladaptive organizational structures, at the expense of other equally important, context-specific factors that operate at smaller scales.

This regrettable tendency has led an increasing number of calls for a more nuanced, multifaceted approach to studying how climatic *and* social factors contributed to the development and trajectory of ancient collapse events (e.g., Tainter 2006; Butzer 2012; Schneider and Adalı 2014). To paraphrase a point I have argued elsewhere (cf. Schneider and Adalı 2014), archaeologists must assume that even if there is an overwhelming body of evidence to suggest that climate change or ecological degradation played a key role in the destabilization of a given social

system, many other important known and unknown contingent factors also influenced the historical trajectory of the events that led up to that outcome.

2.4: An Alternative Approach to Collapse: The “Event-Based” Framework of William H. Sewell

In light of the various problems noted earlier that often bedevil archaeological studies of collapse, it is sometimes difficult to avoid falling into a sort of fatalistic malaise about the prospects for studying societal collapse in the ancient past. But while there are certainly many outstanding issues that require addressing, I do not think that the future of collapse studies in archaeology is hopeless. On the contrary, the growing awareness about the need for more nuanced explanatory models is reason for cautious optimism. But if we are to develop a more nuanced approach to collapse, what is needed urgently is a framework that successfully negotiates the complicated duality of collapse-as-event and collapse-as-process without sacrificing either the importance of comparative analysis or unique historical context.

Happily, there already is a theoretical approach that can make significant headway towards resolving some of these issues: William H. Sewell’s “event-based” approach to the study of social transformation. For Sewell, processes of social change are inextricably connected with *events*, which he defines as “complexes of action that somehow change the course of history” (2005: 8). The word “event” is at once evocative of a discrete, singular happening, like the assassination of Archduke Franz Ferdinand of Austria-Hungary in 1914 by the Serbian anarchist, Gavrilo Princip. But

while individual occurrences such as this certainly qualify as “events” as Sewell defines them, events can *also* be more gradual or ambiguous transformations – for instance, the establishment of printing in Renaissance Europe, or the unfolding ascendancy over the past two decades of the internet as the primary vehicle for global communication and commercial exchange.

Whether they are gradual or punctuated, a defining characteristic of historical events is that they result not because of a single “ultimate” cause, but rather from a multiplicity of specific, historically-constituted causal factors. Indeed, it is the *articulation* of these factors that Sewell argues is the key to understanding how historical events unfold, and how they resulted in the specific transformations of social structures that occur in their wake. As he explains, “[events] always combine social processes with very different temporalities – relatively gradual or long-run social trends, more volatile swings of public opinion, punctual accidental happenings, medium-run political strategies, sudden individual decisions, oscillating economic or climatic rhythms – which are brought together in specific ways, at specific places and times, in a particular sequence” (2005: 9).

Another defining characteristic of Sewellian events is that they not only alter the course of history, but also “transform or reconfigure social relations” in their own time (*ibid*: 9). Events, therefore, do not just transform the course of other discrete historical events, but also alter the underlying social structures which help to shape and form the trajectory of history. Events are capable of this, he argues, because these structures have their own histories, which have themselves been forged by numerous

other events over the course of historical time (*ibid*: 14). Thus, historical events alter not only the course of what follows them in historical time, but also the patterns of social relations which so powerfully influence the eventual course of history.

2.4.1: Towards an event-based archaeology. To date, Sewell's "event-based" approach has gained only limited currency among archaeologists to date (e.g., Beck Jr. *et al.*, 2007).⁶ In my view, however, this framework is, for several reasons, an ideal theoretical foundation from which to initiate archaeological inquiries concerning the causes of specific instances of societal collapse. First of all, by adopting the term "event" to describe instances of collapse, we are able to easily distinguish between "collapse events" and collapse as a generalizable process of societal decline. Secondly, events, as Sewell defines them, spring from the articulation of multiple causal factors with different temporalities. We must therefore attempt to understand how the interplay of relevant causal factors influenced the trajectory of the specific polity or polities under study leading up to their political disintegration. Thirdly, conceiving of collapses as historical events that were caused by numerous mechanisms invites us to develop more nuanced explanations concerning why a given polity was unable to successfully adapt to its new circumstances, rather than falling back on simplistic or reductionist arguments that often do not accurately reflect the complexity of the archaeological or historical evidence.

⁶ It bears mentioning that many of the core tenets of Sewell's event-based approach are mirrored by those of "historical processualism," a relatively recent archaeological theory that was developed partly as an attempt to marry the processual and postprocessual paradigms (cf. Pauketat 2001).

There is also one more reason why an event-based approach to collapse would be valuable in archaeology: it is inherently transdisciplinary. Given that important causal factors for collapse events can include everything from climate change to economic arrangements to ideological belief systems, attempts to fully explain the complex causal mechanisms of collapse events will often provide the impetus for engagement with a diverse range of other disciplines, including (but by no means limited to) art history, climatology, ecology, economics, history, or even religious studies. Consequently, Sewell's paradigm invites us to widen the scope of interdisciplinary collaboration even further than it has been by the socio-natural studies school of archaeological thought, and as a result can help to render the study of ancient societal collapse events – and of the underlying processes that help to cause them – a truly interdisciplinary realm of inquiry.

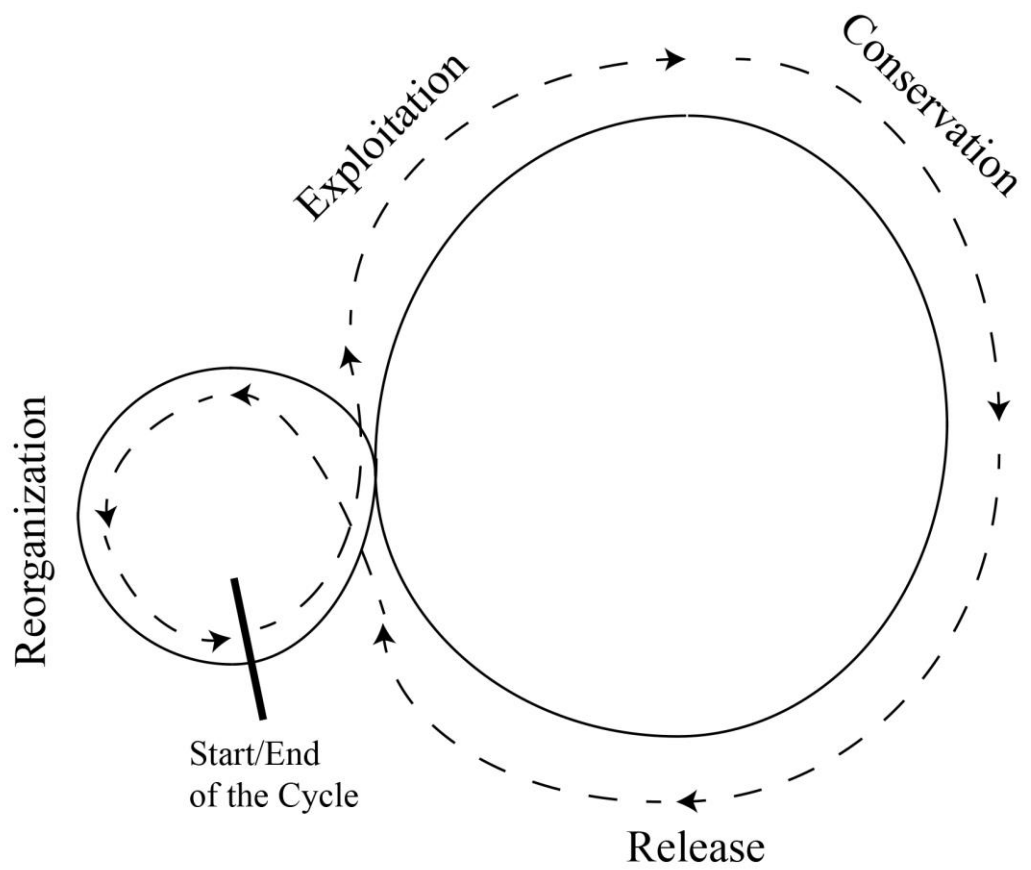


Figure 2-1: A pictorial representation of the “adaptive cycle” of resilience theory.

Chapter 3: The Spatial and Temporal Setting of the Present Study

If we are to understand the events that took place in the Karababa Basin during the Early Bronze Age, then it is best to begin with a description of the natural setting in which those events took place, and the chronological basis for the timing of those events. I turn now, therefore, from the abstract realm of archaeological theories of collapse to address these more prosaic topics in this chapter.

3.1: The Geography, Climate, and Ecology of the Study Area and the Northern Mesopotamian Region

The present work focuses primarily upon events in the ancient Karababa Basin, a catchment basin of the Euphrates River in southeastern Turkey situated between the modern towns of Hilvan and Halfeti (see Figure 3-1). This area, however, did not exist in geographical or social isolation during the Early Bronze Age (nor does it today). Rather, the establishment and decline of its polities was greatly influenced by the natural and cultural forces of a much larger region: northern Mesopotamia. Accordingly, I will begin here by briefly presenting a general overview of the geography, climate, and ecology of the wider northern Mesopotamia region, before moving on to examine the natural setting of the Karababa Basin itself in more detail. The description which follows will draw heavily from the following sources: Algaze *et al.*, 2001; Bottema and Cappers 2000; Deckers and Pessin 2011; Reculeau 2011; and Wilkinson 1990. All other references will be directly cited within the text.

The term Northern Mesopotamia (also “Upper Mesopotamia” or “Syro-Mesopotamia”) is the name given to all the lands north and west of the alluvial heartland of Babylonia and Sumer. It is difficult to make sense of the area without understanding its geographical position in the larger context of all lands inhabited by peoples with what might be termed a shared Mesopotamian culture – people who shared the cuneiform script, similar administrative and economic organizations, similar notions of kingship, overlapping (but not identical) religious traditions, etc. The geography of this larger Mesopotamian culture area can be broadly split into three separate subregions. The southern heartland of Babylonia and Sumer is often simply called “Mesopotamia;” this consists of a flat alluvial plain that spreads south approximately from the modern city of Baghdad, and that is gradually interspersed with marshlands towards the Persian Gulf. To the immediate north and east of this area is a territory generally called “Assyria” in archaeological literature, which follows the Tigris and its tributaries into the Taurus and Zagros Mountains. The third subregion – the natural setting for this study – is Upper Mesopotamia, which stretches from the Orontes River in northwestern Syria, across the Upper and Middle Euphrates valley and the catchments of its associated tributaries, eastward into the Upper Tigris and finally into the plains that lie between the Tigris and the Zagros foothills. Within this area, I will primarily focus upon the Middle Euphrates Valley, which extends from the Karababa Basin in the north to roughly where the Euphrates crosses the modern Syrian/Iraqi border in the south.

The area of Upper Mesopotamia defined above is typically divided into sectors that roughly correspond to particular catchment areas for the Euphrates and its main tributaries, the Balikh and the Khabur (Fig. 1.1). (The descriptions of each that follow are derived from Reculeau 2011: 10-14.) Because of its lengthy, meandering course, and the distinct character of material culture assemblages from ancient sites located in different sections of the valley, the Euphrates is generally divided into four subregions. The furthest downstream sector is known as the Syrian Lower Euphrates Valley, which extends from the city of Halabiya to the Iraqi border. Immediately upstream of this is the Syrian Middle Euphrates Valley, which follows the river southeast from Meskene to Halabiya. Further upstream is the Syrian Upper Euphrates Valley, which extends northward from Meskene to the Turkish border. The uppermost portion of the Euphrates in Mesopotamia is the Turkish Euphrates Valley, which spans north and east from Carchemish on the modern Turkish-Syrian border along the river into the Taurus Mountains, where its headwaters are located. (The Karababa Basin, in turn, is a subdivision of the Lower Turkish Euphrates Valley.) The topography of this area played a crucial role in the development of Early Bronze Age networks of communication and trade, which will be discussed in Chapters 5 and 6.

Although both rivers are now dead, the drainage basins of the two major tributaries of the Euphrates – the Balikh and the Khabur – are also each considered distinct subregions. The Balikh Valley is much like a miniature version of the Euphrates Valley, extending roughly north-south from the Syro-Turkish border to where it joins the Euphrates near the modern city of Raqqah in Syria. The Khabur

Basin,⁷ on the other hand, is unique in Upper Mesopotamia, in that it transitions near the modern city of Hasakah from a wide drainage basin containing numerous small branches (the Upper Khabur), to a single branch that flows south to meet the Euphrates near the Syrian-Iraqi border (the Lower Khabur).

The present-day climate of Upper Mesopotamia is typically characterized as semi-arid; Reculeau describes it as a “degraded mediterranean type transiting towards continentality and aridity” (2011: 14). Precipitation today is distinctly seasonal, with almost all precipitation falling in the late autumn, winter, and early spring (NDJFM). Winter precipitation that falls on the region occurs as a result of mid-latitude cyclones that form over the Mediterranean during the winter months (Cullen and deMenocal 2000).

The highly seasonal character of rainfall in Upper Mesopotamia is largely a result of the presence of large, semi-permanent anticyclones that form over the Azores, which direct Atlantic air masses away from the Mediterranean Basin and into northern Europe (*ibid*). Although they can form during any time of year, these anticyclones occur with greater frequency during the summer and early autumn than in the winter (Katsoulis *et al.*, 1998). These high pressure zones are influenced by the weather system known as the North Atlantic Oscillation (NAO), which appears to govern two major pressure systems in the North Atlantic Ocean: the high pressure anticyclonic system over the Azores, and a low pressure system that forms off of southern Greenland. In years when the high and low pressure systems are weak

⁷ Because of its shape, this area is often known as the “Khabur Triangle.”

(“negative NAO years”), Atlantic moisture travels relatively unimpeded across the Mediterranean; in years when they are more intense (“positive NAO years”, moisture is shunted into Scandinavia and Northern Europe, and the Mediterranean winter is relatively dry (Cullen and deMenocal 2000: 859). The effects of the NAO in Upper Mesopotamia are felt particularly in the discharge rates of the Euphrates and the Tigris. Before being dammed in the late twentieth century, variation in annual precipitation also affected the flow rates of the Euphrates and the Tigris considerably; Cullen and deMenocal report that during the period 1929-1972, the Tigris-Euphrates drainage exhibited a nearly sixfold variation in annual flow rates (2000: 856).

While climate in Syro-Mesopotamia is largely controlled by the NAO, other factors such as topography, altitude, and latitude can cause local (and regional) conditions to vary considerably. Within the region there exists a strong north-south gradient from wetter to drier conditions, with an average annual precipitation of 450 mm or more in the Taurus foothills that form its northern boundary, and as little as 150 mm in the southern *jazirah* (Deckers and Pessin 2011: 33; cf also Reculeau 2011: 15-17). This sharp rainfall gradient can result in the appearance of startlingly distinct microclimates, even within a fairly small area.

Interannual and seasonal variation in decadal precipitation levels in the Turkish portion of Upper Mesopotamia is demonstrated by a 1998 Turkish meteorological study (Türkeş 1998). The report indicated that in modern times the driest areas of Turkey are those which lie in the rain shadow on the lee side of the Taurus Mountains – an area that includes the Turkish Euphrates Basin – which prevent most of the

Mediterranean moisture that is deposited during storms from ever reaching those areas (*ibid*: 657). Moreover, the same study found that not only is the leeward interior of southeastern Anatolia the driest region of Turkey, but it also exhibits the highest interannual variation in seasonal and annual precipitation, with the decadal variation in spring rainfall being as high as 59% of the mean value in the southeastern district of Adiyaman (*ibid*: 659). As a result, mean winter precipitation is comparatively minimal and relatively unstable in the Turkish Euphrates catchment area. Given the region's low seasonal and annual mean precipitation levels, and its high variability in interannual and seasonal precipitation, the Türkeş study concluded that the southeastern Anatolian interior should be considered "prone to prolonged and more intensive summer dryness" than elsewhere in Anatolia (*ibid*). In other words, what would be a relatively minor drought on the Black Sea or the Mediterranean coast would have a substantially greater impact on southeastern Turkish provinces on the lee side of the Taurus – an area which includes the Karababa Basin.

Given the high seasonality and interannual variability of Near Eastern precipitation, it should come as no surprise that droughts are a common occurrence. In Turkey, for example, three major dry periods took place between 1930 and 1993 (1955-1961; 1970-1974; 1982-93, minus two wetter years in 1987 and 1988), with severe nationwide droughts occurring in 1973, 1984, 1989, and 1990 (Türkeş 1996). In Iraq, which on the whole receives less precipitation than Turkey, the climatic situation is even more precarious. For example, a 30-year dry period took place between 1980-2010. During this interval, several severe nation-wide drought events

occurred (in 1983, 1998-2000, and 2008), and localized drought events that affected one or more regions of Iraq occurred during a further 7 years of that same period (1987, 1989-1990, 2001-2005, 2007, and 2009) (Al-Timimi and Al-Jiboori 2013). Thus, in Turkey, 4 out the 22 drier than average years (~18%) were characterized by nationwide drought events, while in Iraq, there were 4 nationwide drought event years in a 30 year period (~13%). If, however, one also counts regional drought events as well, then severely dry conditions prevailed in at least part of Iraq in roughly half of that span.

In addition to illustrating that the Near East is frequently beset with droughts, these data also demonstrate that, at least in the case of both modern Turkey and Iraq, severe drought events tend not to occur in isolation, but rather within longer multi-year dry periods. Moreover, because the current climatic patterns of the Eastern Mediterranean region have been broadly similar for the last 5000 years (Roberts *et al.*, 2001: 721), the character of dry periods in the modern Near East described above is likely to have been very similar to those that occurred during the 3rd millennium BC.

A third aspect of the Upper Mesopotamian natural setting that requires some discussion is its ecology. The present-day ecology of Upper Mesopotamia has been so completely degraded by anthropogenic activity that “virtually no part of [it] can be seen as natural anymore” (Reculeau 2011: 23). Nevertheless, it is still possible to characterize ecological conditions in areas that are currently relatively untouched by human impact, or to reconstruct what conditions would have been like in areas that have been heavily degraded by past and present human activity (*ibid*).

The present-day ecology of the region, such as it is, can be divided into four more or less distinct biomes. Of these, the zone containing the densest biomass is undoubtedly riverine woodland, which can be found on the banks of those rivers and streams which supply sufficient moisture to support a relative abundance of plant life. Outside of the riverine valleys themselves, the regional ecology is characterized principally by three biomes: open park woodland, which is restricted to higher latitudes and/or elevations, where mean annual precipitation is 300+ mm/year; a transitional semi-arid steppe-forest, where mean annual rainfall is between 200-300 mm/year; and finally, beyond the steppe-forest lies a semi-desert steppe (which will henceforth be referred to by its Arabic name, “*jazirah*”), which gets less an average annual precipitation of <200 mm/year. A brief description of each biome is as follows:

Riverine woodland: Despite the greater density of biomass in this zone, the overall plant species diversity of this biome is actually quite low (Deckers and Pessin 2010: 224). In terms of flora, this biome is dominated by poplar, tamarisk, and willow, with smaller numbers of elm, ash, wolfberry, boxwood, and wild fig shrubs (Reculeau 2011: 24-25). It should also be noted that although they no longer exist today, considerable tracts of freshwater marshland could be still found in some riverine areas, such as portions of the Balikh Valley in Syria, until the latter half of the 20th century (cf. Mallowan 1946; Wilkinson 1998: 65).

Open park woodland: This biome is characterized by Reculeau as “a mosaic of oak-dominated areas interspersed with grassland” (2011: 23). Apart from oak, tree

species which grow in this environment today include wild almond and dryland maple (*ibid*). Shrubs, perennials, and grasses are also widespread, particularly in open areas, including needle-leaved juniper; sumac; bromes; wild einkorn wheat; wild mountain rye; wild oats; clover, and wild relatives of fenugreek (*ibid*).

Semi-arid steppe-forest: Areas which lie between the 200 mm and 300 mm isohyets can be characterized as a transitional zone of *semi-arid steppe-forest* (*ibid*). In this biome, the decreased amount of annual precipitation is reflected in drier soil conditions, particularly during the summer months (e.g, Boerma 1988: 2). However, despite the rather inhospitable soil climate in this biome, a number of native species of wild plants found in the semi-arid steppe-forest today are known to have been connected with grazing or used as animal fodder in antiquity, including the following: *Alyssum alyssoides*; *Bromus sterilis*; *Carex divisa*; *Chenopodium murale*; *Chenopodium rubrum*; *Scirpus maritimus*; *Trifolium pretense*; *Veronica persica* (Bottema and Cappers 2000:50). Moreover, trees and other woody plants appear less frequently in this biome than in open park woodland, but are not unheard of; almond, turpentine, and even pear trees can be found in this transitional zone (Reculeau 2011: 24). Thus, although the semi-arid steppe-forest is on the margin for dry farming, this biome was (and is) able to support small-scale agriculture, even in the absence of irrigation.

Semi-desert jazirah: To the south of the 200 mm isohyet line, the ecology of Upper Mesopotamia is characterized as the *semi-desert jazirah*, which extends deep into the continental interior of the Near East. The *jazirah* is a hot, open plain, in

which the most plentiful forms of vegetation are species of grasses specially adapted to arid conditions (cf. Reculeau 2011: 24; also Deckers and Pessin 2010). This biome is much less hospitable for human habitation than either open park woodland or semi-arid steppe forest: dry farming is impossible in the *jazirah*, which receives too little precipitation to support agriculture without irrigation (cf. Boerma 1988; Wilkinson 1994, 2000).

Zooarchaeological finds from numerous ancient sites throughout northern Mesopotamia demonstrate that across these various biomes, the region was home to a considerable variety of animal wildlife in antiquity. At Tilbeşar Höyük in the Turkish Euphrates Valley, Early Bronze Age levels contained remains of gazelle, onager, several deer species (*Capreolus capreolus*, *Cervus*, and *Dama*), fox, and hare, while Middle Bronze levels also contained remains of tortoise, European green toad (*Bufo viridis*), and river crab (cf. Berthon and Mashkour 2008: Table 1). The faunal assemblage from Tell Beydar, an urban center located in the Khabur drainage, provides evidence of an even greater zoological diversity. Within the 3rd millennium levels of Beydar, identifiable faunal skeletal remains included those of numerous species of wild ungulates and bovids (wild onager [*Equus hemionus*], goitred gazelle [*Gazella subgutturosa*], red deer [*Cervus elaphus*], wild goat [*Capra aegagrus*] and wild sheep [*Ovis ammon*]), hare, fox, weasel, and even beaver (cf. Siracusano 2014: Table 2). The presence of the latter, along with remains of various waterfowl, common toad (*B. bufo*), fish, river crab, and freshwater bivalves (*ibid*: 293; also Table 2), suggests that the local riverine woodland and freshwater marsh environments were

extensive enough in at least some areas to support aquatic as well as terrestrial biodiversity for the much if not all of the 3rd millennium BC, despite the semi-arid conditions which are characteristic of the region.

3.1.1: The geography, climate, and ecology of the Karababa Basin.

Having just provided some background about the regional setting for the present study, I turn here to discuss the Karababa Basin itself. The description that follows is based primarily on the following sources: Wilkinson 1990, Algaze *et al.*, 2001, Allentuck and Greenfield 2010, Hald 2010, and Algaze and Matney 2011. Any other references will be directly cited within the text.

The boundaries of the study area form a rectangle which is roughly bisected by the Euphrates as it flows east-west between the modern Turkish towns of Hilvan and Halfeti, where the Euphrates turns south towards the Syrian border (see Figure 3-1). The northern boundary of the study area can be placed roughly at the latitude of the modern Turkish city of Adiyaman, while the city of Şanlıurfa will be assigned as the approximate southern limit of the study area. Of special importance within the study area is a catchment area of the Euphrates known as the Karababa Basin, now largely flooded by the completion of the Atatürk Dam.

The geological landscape of the study area has been shaped largely by the same tectonic processes responsible for forming the Anti-Taurus Mountains to the north, a chain that “mainly developed as a result of collision of the Arabian and the Anatolian plates” (Ulu and Karahanoglu 1998: 806). It is no surprise, therefore, that this area remains tectonically active today; much of it lies within the East Anatolian

Fault Zone (EAFZ) that forms the boundary between the two plates (Westaway *et al.*, 2008). Additionally, a smaller tectonic fault known as the Bozova fault runs in a NW-SE line through the northeastern end of the study area (cf. Lovelock 1984: fig. 1).

To the east of this fault the terrain slowly rises up towards a geological formation known as the Mardin High that extends southeastward towards the Syrian and Iraqi borders, while the area which lies to the south and west of the Bozova fault is part of the Arabian Platform (*ibid*). The latter, which is also known as the Urfa-Gaziantep Plateau, is characterized as an area of rolling hills dotted with Eocene and Cretaceous limestone scarps, many of which are highly eroded; this plateau is also interspersed with land of varied terrain and elevation, particularly in the immediate vicinity of the Euphrates (cf. Wilkinson 1990: 5-11, Fig. 1.2). Finally, as one travels further south from the Urfa-Gaziantep Plateau, the terrain ultimately levels out into a series of fertile, low-lying basins, such as the Harran Basin (also called the Harran Plain), which extend towards the modern border with Syria (*ibid*: 11).

The primary watercourse in the Karababa Basin is the Euphrates River. Although much of its ancient channel is now totally submerged as a result of the construction of the Atatürk and Birecik Dams (cf. Demir *et al.*, 2007: 2846-47, also Fig. 2), during the Early Bronze Age the Euphrates was fast-flowing and its channel deeply incised (Kuzucuoglu *et al.*, 2004: 203), except at a natural ford in the vicinity of Samsat (Algaze *et al.*, 2001: 62). Apart from the Euphrates, there are also a number of comparatively small tributary rivers and streams within the Karababa, some of

which are still flowing, while others that were perennial in antiquity are now seasonal or have completely dried up.

Because its rainfall is derived from the same cyclonic storm systems that bring precipitation to the rest of Upper Mesopotamia, the climate of the Karababa Basin is on the whole similar to that of other parts of Upper Mesopotamia, although the area lies within a zone of relatively high annual precipitation (c. 400-470 mm/year; cf. Wilkinson 1994: 484). Similarly, as is true of Upper Mesopotamia in general, sudden shifts in climate also occur in the Turkish Euphrates Valley. However, local climatic variation of the Karababa area may be even more pronounced than in the lowland *jazirah* because of the orographic effects of the nearby Taurus Mountains. Indeed, in mountainous regions such as the Taurus, “[l]ocal contrasts of slope angle and orientation give rise to such large variation in local climatic condition that it seems doubtful whether the concept of a ‘regional mountain climate’ has much validity or value” (Barry 2008: 13). Thus, in the vicinity of the Karababa Basin, local environments range “from a moist, sub-humid climate along the Anti- Taurus fringes (Adiyaman-Kahta area) through a dry, sub-humid along the Euphrates to a semiarid climate between Bozova and the Syrian border” (Wilkinson 1990: 11). Recently published stable oxygen isotope evidence also demonstrates the high variability of modern rainfall in this area along the north-south gradient (Dirican *et al.*, 2005).

The suddenness with which conditions can change in the Karababa Basin, especially from north-to-south, is also reflected in land use. Wilkinson explains how modern agricultural practices in this area illustrate the considerable changes in

humidity and precipitation that can take place even within the space of a few miles: “The decrease in rainfall away from the mountains is particularly rapid between the [Taurus] foothills and the Euphrates [. . .] this is echoed by the land use: for example, tobacco grows to the north of the river but not to the south where the climate is too dry” (1990: 13). Based upon the observations and data reported above, then, it is possible to tentatively consider the Euphrates as a rough “isohyet line” within the Karababa area, with conditions to the north of the river being wetter than those to the south.

Because the Karababa Basin receives more than 300 mm/year of rainfall, its ecology is best characterized as the open-park woodland described above. However, as a result of deforestation by the residents of Titriş Höyük during the Early Bronze Age (which will be discussed further in Chapter 6), the area is decidedly more “open park” than “woodland” today. The extreme southern portion of the Karababa is close to the 300 mm isohyet line, and thus its ecology is possibly nearer to that of transitional semi-arid steppe-forest.

The faunal biodiversity of the Karababa Basin is rather similar to that of the larger region, as described above. The faunal assemblage of Titriş Höyük, which contains over 22,000 bones (Allentuck and Greenfield 2010: 14), provides a good indication of the level of biodiversity present in the Karababa Basin during the 3rd millennium BC. Non-domesticated animal taxa identified in the Titriş collection (cf. *ibid*: Table 2.3) include aurochs, bezoar goat, three different species of deer

(*Capreolus capreolus*, *Cervus elaphus*, and *Dama dama*), hare, mustelid, and beaver. Further bones could only be identified as “equid” or “carnivore” (*ibid*).

Other archaeological sites in the study area have yielded additional evidence of further biodiversity for the mid-to-late 3rd millennium of the Karababa Basin. At Kurban Höyük (Kurban Period IV), in addition to those taxa also represented at Titriş, the remains of gazelles, foxes, and wild pigs were also identified (cf. Wattenmaker 1998: Table 18). And the faunal assemblage for late 4th millennium levels at Hacinebi also included bear and tortoise remains – although not this does not necessarily indicate that the same would have been true during the 3rd millennium (Bigelow 1999: Table 1).

Overall, the Karababa faunal assemblages include both animals that tend to prefer open grasslands, such as gazelles, and those that are more typically found in forests, such as bears and wild pigs. Thus, these collection appear to confirm that the Karababa Basin was primarily a region of terrestrial open park woodland environment. It should be noted, however, that the presence of beaver at Titriş – albeit only a single animal – hints at the possibility that riparian woodland may have been fairly extensive during at least part of the 3rd millennium, as well.

3.2: Relative and Absolute Chronologies

Having described the spatial setting for the present study, I turn now to address the temporal setting for this investigation. However, before I begin, I must first point that the various local and regional chronologies noted below are not always consistent,

even though they frequent overlap with each other. (All dates mentioned in this dissertation are given as BC/AD calendar dates, unless specifically given as BP or ka.)

3.2.1: Early Bronze Age relative chronologies for the Karababa Basin.

The “Early Bronze Age” (otherwise EB or EBA, for short) is a common designation in many parts of the Mediterranean and Near East. Unfortunately, these labels often do not temporally correspond to each other. Henceforth, unless otherwise specified, the term will here be used to refer specifically to *the Early Bronze Age in Mesopotamian archaeology*, which roughly corresponds with the third millennium BC. In this scheme, the EBA is generally broken up into three phases: Early EBA, Middle (or Mid-) EBA, and Late EBA. (NOTE: All dates given here will follow Akkermans and Schwartz 2003, unless otherwise indicated.) The earliest phase of the EBA, known as the *Early EBA (c. 3000-c. 2700 BCE)*, was characterized in Upper Mesopotamia by a lack of urban settlements, and a low population density throughout the region. During the middle of the third millennium, a second phase, known as the *Middle EBA (c. 2700-c. 2300 BCE)* saw the sudden and widespread adoption of urbanism across the region. This florescence of cities proved to be short-lived, and much of this region experienced a major contraction away from urbanization and social complexity by the end of the *Late EBA (c. 2300-c. 2000 BCE)*.

Although Titriş Höyük was the largest settlement in the Karababa Basin during the Early Bronze Age, it is not the type-site for the ceramic chronology of the EBA in the Karababa Basin. The type-site for the area is instead the smaller secondary center of Kurban Höyük, which, despite its comparatively diminutive size, has yielded

arguably the most complete currently published ceramic chronology of any EBA site in the catchment basin. This ceramic chronology features a continuous sequence that reaches back to at least the Middle and Late Halaf Period (Kurban Period VIII), and lasts up to the beginning of the Middle Bronze Age (Kurban Period III).

Algaze (1990) has subdivided the Early Bronze Age layers of Kurban Höyük into three distinct phases: Kurban Periods V (or Early EB), IV (or Mid-Late EB), and III (or EB-MB Transition). Kurban Period V has been dated to the Jemdet Nasr and ED I (and possibly ED II) phases of southern Mesopotamia (Algaze 1990: 297). Characteristic ceramic types for this period include Dense Greenish Plain Simple Ware, Diagonally Reserved Slip Ware, and several kinds of Plain Simple Wares, including bowls, jars, stands, and pedestal bases (cf. Algaze 1990: 282-287).

Kurban Period IV spans the middle centuries of the 3rd millennium BC. Algaze (1990) has further divided this period into distinct subphases (in order from earliest to latest): Kurban IVC, IVB, and IVA. Throughout this entire period, the most common vessel types, by far, are plain simple and cooking pot wares (*ibid*: 335). Unique to the Kurban IVC ceramic assemblage are painted band and combed wash wares, which are absent from IVA-B (*ibid*: 336). Conversely, large, ovoid jars and metallic ware globular jars with high necks are commonplace in Kurban IVA-B, but virtually unknown in IVC (*ibid*: 337-338). Small finds from Titriş Höyük, and also nearby Lidar Höyük, have helped to anchor the Kurban IV sequence to better-established chronologies in southern Mesopotamia. Of especial significance for dating purposes are cylinder seals with clear southern Mesopotamian Early Dynastic III characteristics

that were found at Lidar Höyük (and in at least one case, looted from a Mid EBA tomb at Titriş Höyük), all of which occur in contexts that are equivalent to Kurban Period IV (Algaze 1990: 344).⁸

The ceramic assemblage of Period III at Kurban is intriguing: in Area D, ceramic vessels associated with the early MB in Syria are found alongside those which are typically seen as being late EB types (cf. Algaze 1990: 387). For this reason, this phase is assigned somewhat tenuously to an “EB-MB transition” period. Kurban III almost certainly postdates the Akkadian sack of Ebla (*ibid*: 386). It is less clear when this occupation phase ended, but as Algaze considers Kurban III to be “a relatively thin ‘chronological slice’ that appears to bridge the gap between the end of the EB and the beginnings of the MB in northern Syria and northern Mesopotamia” (*ibid*: 387), then the end of Kurban III probably dates to the beginning of the 2nd millennium BC.

However, not all sites in the Karababa Basin derive their local ceramic chronologies from this sequence. The three 3rd millennium phases at Gritille Höyük, for example, are based instead on the oft-employed ceramic sequence for the Amuq Valley of northwestern Syria (cf. discussion in Stein 1988, *unpublished dissertation*: 126). Because archaeological samples of faunal tooth enamel from Gritille Höyük feature in the stable isotope analysis conducted in this study, and also because of the fact that the Kurban site sequence described above is partly derived from the Amuq chronology as well, it is therefore worthwhile to also say a few words about the Amuq

⁸ By this same token, because ceramics of the same types and styles that have been used to date the phases at Kurban have also been found at Titriş Höyük, the Kurban site chronology also serves as the basis for the site chronology of the latter (cf. for example Algaze *et al.*, 1992).

sequence for the Early Bronze Age.

Like the Kurban Höyük sequence, the Amuq sequence for the Early Bronze Age is subdivided into three distinct phases (cf. Braidwood and Braidwood 1960). The oldest of these is Amuq Phase H, which is identified by the emergence of a new ceramic style known as Red-Black Burnished Ware, and has been identified with the southern Mesopotamian late ED I and early ED III periods (*ibid*: 519). This phase was followed by Amuq I, during which Simple Ware truncated conical cups and goblets are found in the ceramic assemblage, along with Smearred-Wash Ware (*ibid*: 520). Amuq I has been dated to the ED III and a curiously-named “Protoimperial” period in southern Mesopotamia. The final EB phase in the Amuq sequence is Amuq J, which Braidwood and Braidwood consider to be the local equivalent of the Old Akkadian and Ur III periods in Babylonia (*ibid*: 523). The ceramic assemblage of Amuq J exhibits considerable continuity with Amuq I, notably the Simple Ware cups and goblets, and also features so-called “teapot” with black-on-white decoration (*ibid*: 521).

3.2.2: Absolute chronologies for the Karababa Basin during the Early Bronze Age. Although the archaeological record allows for the establishment of a reasonably secure relative chronology at Titriş Höyük between succeeding phases of occupation, very few radiocarbon dates⁹ from the site have been run thus far, while those that have been run have large error ranges (cf. Algaze *et al.*, 2001: 48-9). Based on these radiocarbon dates, the Early EBA occupation has been placed at 3210-2780

⁹ It should be noted that these are not AMS ¹⁴C dates.

BCE (*ibid*: 49). Radiocarbon dates for the Middle EBA period are even more problematic than those for the Early EBA, as two of the three determinants for this period, which were recovered from the same stratigraphic sounding, are dated to several centuries earlier than the third determinant. As a result, two possible ranges exist for this period: 2850-2250 BCE if all three are used, and 2850-2510 BCE if only the two that came from the same trench are used (*ibid*). There are five determinants for the Late EBA, which provide a range of 2500-1900 BCE, unless the later Middle EBA determinant is also assigned to this group, in which case the range becomes 2380-1910 BCE (*ibid*: 49-50). Because of the substantial ranges given for the ^{14}C dates in each occupation phase reported by Algaze *et al.* in 2001, these dates cannot be considered a reliable indication of the absolute chronometric dates that correspond to each period identified in the ceramic chronology of Titriş Höyük.

Given the uncertainty of the existing absolute chronology for the Early Bronze Age at Titriş Höyük, an important aspect of this research was the establishment of a newer, more reliable sequence based on accelerated mass spectrometry (AMS) radiocarbon dates. This new ^{14}C chronology was established from seven samples¹⁰ of human bone and faunal tooth dentine from the site of Titriş Höyük (see Table 3-1). One of these was dated to the Early EBA occupation phase, two to the Middle EBA phase, and four to the Late EBA phase. All seven samples were processed and analyzed at the University of Arizona-NSF Radiocarbon Lab, and were subsequently calibrated with CALIB 7.1 software.

¹⁰ One tooth dentine sample failed to yield usable collagen for analysis, and was subsequently replaced with another from the same period (AA104971).

Of the seven samples sent off for analysis, five yielded AMS ^{14}C dates that conformed to expectations from the ceramic chronology of the Titriş Höyük, and were subsequently used to develop the refined age model for the occupation phases of the site. Three of these dates (AA104969, AA104973, and AA104974) were recovered from Late EBA contexts at Titriş Höyük, while two (AA104971 and AA104972) came from Mid EBA ones. The ^{14}C dates reported for two of the samples did not conform to expectation, and were subsequently discarded from the age model. Sample AA104970, which was recovered from Late EBA layers at Titriş, was several centuries too old (2- σ calibrated range: 2913-2668 BC). Sample AA104975, which was found in Early EBA levels at Titriş, and should therefore have provided the earliest date, instead dates to the late 10th- 12th centuries AD (2- σ calibrated range: 991-1161 AD).

On the basis of the dates obtained for the Middle and Late EBA periods, the absolute chronology of these periods can be revised from the earlier Titriş Höyük radiocarbon chronology reported in 2001 by Algaze *et al.* Unfortunately, because the ^{14}C date of the determinant for the Early EBA period was not valid, no revision to the existing radiocarbon chronology can be made for this period of occupation. It is possible, however, to provide new tentative radiocarbon date ranges for the Middle and Late EBA period: the mean 2- σ calibrated range for the Middle EBA is 2872-2534 BC; while that of the Late EBA is 2499-2188 BC.

On the whole, the AMS-based radiocarbon chronology established here provides slightly earlier dates than the older radiocarbon chronology for Titriş Höyük

(see Table 3-2). One difference between the two that is of potential significance is that the three Late EBA determinants employed in the revised age model provide a much earlier end date for the Late EBA than the old one, which extends the Early Bronze Age duration of the urban center into the early 2nd millennium BC. The significance of these new dates can hardly be overstated; if the AMS-based chronology is indeed a more accurate reflection of the historical duration of the final occupation phase, then the termination of the Late EBA would have been contemporaneous to the collapse of Tell Leilan and other sites in northern Mesopotamia which, as Weiss and others have argued, was a direct result of the 4.2 ka BP event.

Table 3-1: AMS ^{14}C Dates for Titriş Höyük.

AA #	Sample #	Period	Type	^{14}C Age BP	D^{14}C Age	Calibrated 1- σ range (BC)	Calibrated 2- σ range (BC)
AA104969	AS-0537	Late EB	Ovicaprid	3898	65	2470-2294	2568-2154
AA104970	AS-0532a	Late EB	Ovicaprid	4224	44	2900-2706	2913-2668
AA104971	AS-0530	Mid EB	Ovicaprid	4081	53	2850-2499	2866-2485
AA104972	AS-0528	Mid EB	Ovicaprid	4141	44	2866-2633	2877-2583
AA104973	AS-0552	Late EB	Human	3874	42	2454-2296	2468-2208
AA104974	AS-0555	Late EB	Human	3850	42	2448-2210	2462-2203
AA104975	AS-0544	Early EB	Human	970	44	1019-1151 AD	991-1161 AD

Note. Dates highlighted in red were excluded from the age model.

Table 3-2: A Side-by-Side Comparison of the Old Radiocarbon Site Chronology for Titriş Höyük with the New AMS-Based Chronology.

Period	Old ^{14}C Chronology	New AMS ^{14}C Chronology
Early EBA	3210-2780 BC	N/A
Mid EBA	2850-2510 BC/2850-2250 BC	2872-2534 BC
Late EBA	2500-1900BC/2380-1910 BC	2499-2188 BC



Figure 3-1: A map of the northern Near East (original satellite image courtesy of NASA). The study area is highlighted in the red box.

Chapter 4: Archaeological Evidence for Regional Cultural Developments and Trajectories in Northern Mesopotamia and Northwestern Syria

The Early Bronze Age was a time of profound and rapid change in northern Mesopotamia, during which the region “experienced one of the most important transformations in its history - the full-fledged adoption of urban life and its associated institutions” (Akkermans and Schwartz 2003: 233). This shift was not simply a matter of an explosion in population, or the development of cities. These growing urban communities¹¹ also began to employ full-time specialist craftspeople who produced pottery, metalwork, and other goods for local consumption and long-distance commercial exchange. And presiding over all of this growth and productivity was an emerging class of rulers, aristocrats, and administrators who sat at the top of increasingly stratified social hierarchies.

This chapter provides a brief overview of the cultural, economic, and political developments in Early Bronze Age northern Mesopotamia. But before proceeding any further, I must first pause here to say a few words concerning the nature of the archaeological evidence upon which our current understanding of Early Bronze Age Upper Mesopotamian political economies is based. To begin with, it must be said that what follows should not be considered a comprehensive review of the evidence for increased economic and social complexity during this period. Such an extensive discussion is beyond the scope of the present study (and in any case, an excellent

¹¹ The locations of the EBA Upper Mesopotamian sites discussed in the text are shown in Figure 4-1.

treatment of these processes can be found in Cooper 2006). Rather, this review will touch upon the main points of these transformations, along with those that will have some bearing upon the multicausal model for the decline of Titriş Höyük I will propose in Chapter 11.

Additionally, it should be noted that because many of the sites in the region – including Titriş Höyük – have not to date yielded any direct textual evidence that would shed light on aspects of local political economies that are difficult to access through other evidence (i.e., things such as the rations provided by the state to people of various occupations, or the structure and duties of city administrative departments). Accordingly, I have been forced to largely rely, as we so often do in Mesopotamian archaeology, upon the conflation of existing information from sites for which we have nothing but archaeological evidence with the textual records provided from those sites such as Ebla or Tell Beydar that have provided direct textual accounts concerning these practices and policies. Moreover, it will also occasionally be necessary to fill in the gaps with textual or archaeological evidence from the southern Mesopotamian alluvium. This practice is not entirely without merit – there is much about the political and economic arrangements that polities in the north and south share in common, as we shall see. Unfortunately, the necessity to fill holes in the archaeological record with data from textual accounts has also led to a number of controversies and misunderstandings. This problem has, unfortunately, been compounded by an occasional tendency on the part of those working with the documents to come to premature conclusions based on incomplete readings or misunderstandings of the

texts; thus creating what J. D. Hawkins, speaking of the controversies surrounding the city of Ebla, has called “a series of unsupported statements on the contents of the archives” (Hawkins 1983: 547 [*review*]).

In addition to the tendency on the part of some scholars to overextrapolate from the textual record, Robert McC. Adams has laid bare another problem that arises from relying too much on the written record (2007: 3): because texts represent only “the myopic view of ancient scribes of their own hinterland,” these documents provide little if any information about the lives of the ordinary people who comprised the vast majority of the population, or of all of the realms of the local economy that fell outside of the purview of the scribal administration. Rather, they tend to expose only the views of some of the elite groups who exercised political, economic, or ideological control over archaic cities and/or states, or of the professional scribes whom those elites employed as record-keepers and administrators.

4.1: Regional EBA Settlement Patterns

4.1.1: The Early EBA. The results of archaeological surveys suggest that the recovery of Upper Mesopotamian agricultural settlements from an earlier episode of imposed urbanization (cf. Algaze 1991), which collapsed at the close of the fourth millennium BCE, was slow. By 2900 BC, the population of Upper Mesopotamia was apparently either living a nomadic lifestyle, or else living in one of numerous small agricultural settlements (cf. Akkermans and Schwartz 2003 210-11; Algaze *et al.*, 1994: 12-13). During the centuries immediately following the abandonment of Upper

Mesopotamian colonial urban centers such as Habuba Kabira (c. 3200 BCE), it appears that societies in the Syrian Euphrates Valley lived almost exclusively in small communities that were little more than isolated agricultural villages (Akkermans and Schwartz 2003: 211). Similarly, Ökse, among others, has noted that at the beginning of the third millennium, “the settlements [were] generally dispersed, small scale, and mostly newly founded” in the Turkish Euphrates sector (Ökse 2011: 267). This evidence suggests that archaeologists might best describe the settlement history of this period as a “post-Uruk hangover”, in which little if any evidence exists for urbanism or high densities of population in the region.

The regression from agglomerated 4th millennium settlements to small, dispersed villages at the beginning of the 3rd millennium also took place in southeastern Anatolia, as is attested in numerous archaeological surveys and excavations. For instance, in a survey of the Birecik-Carchemish sector of the Turkish Euphrates, only nine sites were identified as having Early EBA occupations (Algaze *et al.*, 1994: 12). All of these were very small, not comprising more than 2-3 hectares at the most; by contrast, the same survey identified 16 sites with earlier Middle or Late Uruk occupations, of which the largest, Tıladir Tepe, was at least 12 ha in size (*ibid*: 10-11).¹²

4.1.2: The Mid EBA. The middle centuries of the 3rd millennium BC witnessed one of the most remarkable transformations in the long history of northern Mesopotamia – the sudden florescence of large, densely populated polities based in

¹² It is probable that Carchemish was larger, but it is not yet entirely clear what its Late Chalcolithic/Uruk period dimensions were (Algaze, *pers. comm.*)

urban centers that were the seat of complex and hierarchical social organizations. These polities also engaged in economic competition and exchange (and occasionally conflict), both within the region and with extraregional polities, on a scale previously unknown.

The size of urban settlements during the Middle EBA utterly dwarfed anything that had been previously seen in Upper Mesopotamia. A typical example can be seen in the eastern Khabur Basin, where the largest urban settlement, the site of Tell Hamoukar, measured some 98 ha (Ur 2010: 153). This city was far and away the most important settlement in its region; it was nearly twenty times the size of its largest nearby satellite community, called Site 54, whose Middle EBA occupation measured 5.71 ha in size (*ibid*: 106). As in other parts of Upper Mesopotamia, the explosive growth of Hamoukar during the Middle EBA was not an isolated phenomenon, even within the eastern Khabur; the site of Tell Leilan, located only 55 km northeast of Hamoukar, also “expanded six-fold, from 15 to 90 hectares” by 2400 BC (Weiss 1983: 47). Similarly, Tell Chuera in the Western Balikh attained an area of 100 ha, and Ebla in northwestern Syria an area of 50 ha (cf. Weiss *et al.*, 1983: Figure 11).

While rapid population growth was a hallmark of the Middle EBA, available archaeological survey data suggest that this demographic shift appears to have been limited almost entirely in emerging cities themselves; rural occupations did not, as a rule, experience the vigorous spatial expansion that took place in the urban centers. In some places, such as Tell Hamoukar, the *number* of settlements surrounding the city did increase in comparison to the Early EBA, but the size of these was not

significantly larger than during that earlier period (Ur 2010: Table 6.7). In other areas, the rapid expansion of urban centers was actually accompanied by a reduction in the overall number of hinterland settlements from that of the preceding Early EBA. In the Upper Lake Assad area of the Syrian Euphrates Valley, for example, archaeological surveys identified 11 Early EBA sites, which occupied a total of 9.5 ha; by the Late EBA, only 5 sites remained, but these combined occupations comprised 33.7 ha (cf. Wilkinson 2004: Table 9.1). During this span, the largest site in the area, Tell es-Sweyhat, expanded from a 6 ha village to a modest city of 31 ha (*ibid*). At Sweyhat, then, it seems that the growth of the central settlement came at the cost of smaller rural ones, presumably as a result of continuing migrations from villages and hamlets into the rapidly expanding urban center.

It is important to point out, however, that the expansion of urban settlements in Upper Mesopotamia was not on the same scale as occurred in southern Mesopotamia during this same period. Whereas some individual sites in the alluvial floodplains of Sumer achieved sizes as high as 400+ ha, those in Upper Mesopotamia never expanded beyond approximately 100 ha (Wilkinson 1994: 483; cf. also Table 2). This disparity in extent has been explained as an artifact of the limits of dry-farming agriculture to sustain populations of greater size, particularly in areas with comparatively little rainfall like the Syrian *jazirah* (Wilkinson 1994).

4.1.3: The Late EBA. If the middle centuries of the 3rd millennium were a dynamic period of urban growth and economic expansion for the peoples of Upper Mesopotamia, then the final centuries were a time of considerable stress, conflict, and

in many areas, the collapse of the urban societies which had flourished during the Middle EBA. There seems little doubt that the Late EBA was characterized by a marked decline in the fortunes of urban centers throughout the region, and it is true that many settlements were indeed abandoned during this phase. The extent of the catastrophe however, has sometimes been overstated (e.g., Weiss *et al.*, 1993).

Rather, as we shall see, the turmoil experienced throughout northern Mesopotamia during the final centuries of the 3rd millennium BC did not have uniform characteristics or consequences. The urban complex societies of the region did not all share identical fates – a number survived more or less intact, minimally including Tell Brak and Tell Mozan in the central portion of the Upper Khabur, and Tell Bi'a at the confluence of the Balikh and the Euphrates. Moreover, a few such as Carchemish actually expanded during this period. For this reason, although it is essential to place the evidence from each site into a larger regional context, we must also avoid making assumptions about local developments in any one location on the basis of things that occurred elsewhere in northern Mesopotamia at the same time.

A major complicating factor in understanding the developments that precipitated the collapse of many polities in northern Mesopotamia is the apparent intrusion of the Akkadian Empire into the area at the beginning of the Late EBA. Akkadian sources claim that Sargon, the founder of the Empire, campaigned extensively in the “Upper Country,” which was subjugated by Sargon’s armies during great campaigns of conquest (cf. Heinz 2007; also Akkermans and Schwartz 2003: 278). Similar claims were made by Sargon’s grandson, Naram-Sin, who apparently

crushed a major uprising in Upper Mesopotamia during the so-called “Great Revolt” – which, if the Akkadian sources can be believed, saw a powerful coalition of cities in both northern and southern Mesopotamia join forces in an (unsuccessful) bid to throw off the yoke of Agade.

But while Akkadian sources would have us believe that Agade was a dominating presence in the north, archaeological evidence for this is rather thin on the ground. With the exception of the so-called “Naram-Sin Palace” structure from Late EBA Tell Brak, and one text found within that structure that appears to be a list of workmen from other Khabur cities (cf. Oates *et al.*, 2001: 383-385), there is virtually no other conclusive archaeological or textual evidence for direct Akkadian imperial control over much of Upper Mesopotamia (Ur 2010: 407), except for Tell Brak and Nineveh and, presumably, their immediate surroundings. There are, admittedly, isolated pieces of circumstantial evidence that could arguably be construed as signifying an Akkadian presence in the region (e.g., Algaze 1990: 344-345). And it also true that a number of sites, including Ebla, Mari, and Tuttul (Tell B’ia) appear to have been partially or completely destroyed at roughly the same time as the reigns of the aforementioned Akkadian rulers (Akkermans and Schwartz 2003: 278). However, the small finds discussed already cannot really be considered *prima facie* evidence of Akkadian overlordship in and of themselves, and it remains unclear whether the evidence of deliberate conflagrations are evidence of Akkadian military activity – and, even if they were, whether they represent glorified raids for plunder, or mark the

beginning of direct, permanent Akkadian political administration over those and possibly other urban centers.

What is clear, however, is that whether the Akkadians were involved or not, many urban settlements in northern Mesopotamia were either abandoned or otherwise experienced severe disruptions during the final two centuries of the 3rd millennium BC. The Upper Khabur Basin, located in what is now northeastern Syria, provides some of the most dramatic evidence for late 3rd millennium political and demographic collapse anywhere in Upper Mesopotamia. At its height during the Middle EBA, this area was densely populated and highly urbanized, and it housed many of the largest and most regionally-important urban centers in northern Mesopotamia. The increasing demand upon rain-fed agricultural infrastructure to produce higher yields for the additional population appears to have led to the development of a system of approximately 5 km agricultural catchment zones around population centers, which allowed for more efficient use of agricultural land (Wilkinson 1994). Even this system, however, apparently could not support settlements more than 100-120 ha in size without the advent of intensive irrigation agriculture. Moreover, as Ur has noted, “As settlements approached this ceiling [. . .] the economic system became increasingly susceptible to fluctuations in annual rainfall and could collapse if faced with a multiyear drought” (Ur 2010: 407).

Whatever the reason, most – though by no means all, as I will discuss below – of the polities in the Upper Khabur Basin were destroyed or abandoned during the final centuries of the 3rd millennium BC. For example, “Leilan and the sites in its

vicinity, Beydar, Abu Hgaira, and all the excavated middle Khabur sites were deserted” by 2200 BCE (Akkermans and Schwartz 2003: 283). In the Leilan sector alone, it is estimated that 73% of sites were abandoned, and the total area occupied decreased by over 90% (Staubwasser and Weiss 2006: 382).

The fate of the majority of Khabur urban centers was also shared by many other sites in Syria (cf. Weiss *et al.*, 1993: 999). The pattern of collapse in the Upper Syrian Euphrates Valley is similar to that of the Khabur: Ebla was razed (ostensibly at the hands of Naram-Sin), and many of the secondary centers in its vicinity, including Umm el-Marra, Qannas, and Hammam et-Turkman, were also deserted (Akkermans and Schwartz 2003: 283). Moreover, several of the deserted sites, including the aforementioned Ebla, Qannas, Hammam-et-Turkman, and Tell Sweyhat, appear to have been burned (*ibid*), which suggests that the abandonment of at least some urban centers in this area was also associated with episodes of violent conflict. At Sweyhat, caches of clay sling bullets dating to the final EBA occupation phases of the site (Phase 6 & 6/7) is a further indication that organized violence was a fact of life at this time (Holland 2006: 239-240, 248)

The site stratigraphy and other archaeological finds from Hammam-et-Turkman in the Balikh Valley provide a good example of the often-violent character of the upheavals which accompanied the decline of polities in this region. Excavations in late 3rd millennium levels at Hammam-et-Turkman have uncovered two distinct destruction layers in the site stratigraphy, which indicate that at least part of this settlement was destroyed by fire multiple times. The first of these was

radiocarbon dated to c. 2250 BC; however, given that the EBA occupation of the site “continued into the last quarter of the third millennium with undiminished prosperity,” it would seem that this conflagration did not result in a lasting disruption at the site (Van Loon and Meijer 1988: 698-99). The second destruction layer, on the other hand, which dates to the end of the millennium, apparently resulted in the abandonment of the settlement for a considerable period of time, as the “deserted buildings of Hammam VI lay open to the elements for a considerable period, while elsewhere on the mound layers of debris containing much grey and orange ash are witness to violent destruction followed by non-occupation” (*ibid*).

However, not all polities in this region experienced a “crash” during the Late EBA. In the Upper Khabur, at least two major urban sites, Tell Brak and Tell Mozan, appear to have survived this period intact (Akkermans and Schwartz 2003: 283). What’s more, in the Birecik-Carchemish Corridor of the Euphrates on the Turkish-Syrian border, populations actually expanded during the Late EBA. Between 2200-1900 BC, the overall number of settlements increased from 5 to 27, and the principal city of the region, Carchemish, evolved from a minor urban center into an independent city-state that would play a central role in trade along the Syrian Euphrates during the Middle Bronze Age (cf. Wilkinson 2007: 37-38). As I will note in Chapter 11, the expansion of this city-state is inversely correlated with the decline of Titriş Höyük, and one might possibly speculate that there may have been a connection between these two phenomena.

4.2: Early Bronze Age Subsistence Economies in Northern Mesopotamia

Because ancient Upper Mesopotamian urban societies were sustained by a combination of cereal crop agriculture and pastoralism, understanding the agricultural systems that were employed by these cities is an essential prerequisite to assessing the impacts upon these communities of any change in climate that may have taken place during the Late EBA. Moreover, as the focal point of this proposed study is a paleoclimatic reconstruction based upon stable carbon and oxygen isotope ratios within the enamel of domesticated sheep and goats at Titriş Höyük, it is also important to understand the place of these animals in local subsistence strategies.

4.2.1: Dry-farming in Early Bronze Age Syro-Mesopotamia. The rapid urbanization of EBA Upper Mesopotamia would not have been possible without some means to feed rapidly growing populations, especially as economic specialization began to increase. The most common form of agriculture in the region was dry farming (also called rain-fed agriculture). Because the Euphrates is too deeply incised for irrigation to be feasible north of Emar (modern Meskene) in Syria, people living to the north of this point were almost entirely reliant on rain-fed agriculture for subsistence (Akkermans and Schwartz 2003: 6)¹³.

The inability to supplement rainwater with irrigation channels meant that these communities were particularly dependent on having sufficient annual rainfall, and would have been left with few options in the face of prolonged drought. To a certain

¹³ Irrigation was apparently possible for people living along the major tributaries of the Euphrates, the Balikh and Khabur, although this was often only practiced in later historical periods (cf. Wilkinson 2000: 18).

extent, this problem was apparently solved by a combination of employing a biennial fallow system and fertilizing fields with manure and other domestic waste, which replenished nutrients and improved the water retention capacity in the soils of agricultural fields (Wilkinson 2000: 17). However, in the longer term, the gradual but inevitable reduction of soil productivity over time required communities to invest labor in agricultural extensification as well as intensification, especially as larger surpluses were needed to cope with the pressure of increasing urban populations.¹⁴

In Upper Mesopotamia, as was the case elsewhere in the ancient Near East, cereal agriculture was the main means of subsistence for settled communities (and indeed, in many places it still is today.) Throughout all of Mesopotamia, wheat and barley were the primary staple crops, with barley – the more drought-resistant of the two – becoming increasingly prevalent during and after the 3rd millennium. In addition, some legumes, notably lentils and peas, were important secondary crops (cf. Cooper 2006: 36-38; see also Renfrew 2006 for an overview regarding the adoption of agriculture in the Fertile Crescent.) It should be noted, however, that a study of archaeobotanical remains from the sites of ‘Atij, Raqa’i, and Kerma in the Khabur Basin has showed that legumes disappeared from midden deposits in this area during the 3rd millennium; this has been interpreted as the result of a deliberate effort to focus on cereal crop production in order to support the feeding of much larger herds of animals (McCorriston 1998: 50). In addition to these cereals and legumes, there is

¹⁴ This “solution,” unfortunately, was not sufficient, as these newer, more distant fields were no less resistant to water or nutrient loss than the earlier ones!

also some evidence that acorns may have been systematically harvested in some areas (cf. Algaze *et al.*, 1995: 24-5).

In addition to these basic staple crops, “cash crops” were another element of the farming sector of Early Bronze Age Upper Mesopotamian agricultural economies. These foods were specialty items that could only be grown in certain places, and were thus difficult to obtain, which made them highly desirable luxury imports (cf. Sherratt 1999: 21-26). Plants that were rich in sugar or which also provided valuable secondary products, such as oils or dyes, would likely have been particularly prized commodities (*ibid*: 21).

The hills and terraces of northern Mesopotamia also provided a place for local city-states to grow one particularly important cash crop: grapes. The environments of the northern *jazirah* and Taurus piedmont (along with the southern Levant) appear to have been ideally suited for grape cultivation during the Early Bronze Age (*ibid* 1999: 24). This is borne out by archaeological evidence, as remains of grape are encountered in comparatively large numbers in many sites across Upper Mesopotamia and Jordan (cf. Riehl 2009: 106-7).

Apart from their scarcity, there are two primary reasons why grapes would have been an important cash crop during the Early Bronze Age. First and foremost, they were required for the production of wine. Although this practice probably dates back to the Neolithic (cf. Miller 2008), this beverage seems to have acquired widespread appeal during the Early Bronze Age because of its use in commensal feasting and drinking ceremonies (which will be discussed in more detail in Chapter

5). Indeed, this beverage may even have played an indirect but important role in helping to establish and legitimate the elite status of important family groups within EBA communities (cf. Pollock 2003; also the discussion below). Secondly, as Miller suggests, the increasing importance of grapes as a cultivar during the 3rd millennium, along with the appearance of sweeter varieties of grape during this same period, may indicate that these newer varieties were prized for their sugar content, and may even have been used as sweeteners for other foods (Miller 2008: 944-5). Whatever the reason, it seems that viticulture was practiced on an unprecedented scale during the Early Bronze Age, and it is probable that wine, raisins, syrup, and other grape-based products were important exports for many communities in Upper Mesopotamia, especially during the Middle and Late EBA.

The success of grape cultivation in Upper Mesopotamia during the 3rd millennium is striking, because grapes require a relatively high amount of soil moisture (500-1200 mm) during the winter and spring months (Riehl 2009: 106). Riehl notes that this degree of soil moisture “would, if modern precipitation ranges are considered, require irrigation in all the north Syrian sites” (*ibid*: 106-7). Because so few of these sites have yielded any evidence of irrigation, and yet provide ubiquitous evidence for the presence of grapes, it follows that a combination of winter precipitation, alluvial discharge, and other hydrological factors must have provided sufficient moisture during the Early Bronze Age to allow for grape cultivation on a scale sufficient to permit the export of grape products in addition to local consumption. Moreover, at Tell es-Sweyhat – a region which is presently too far

south for grape cultivation –large-scale wine presses of indeterminate date, but which could potentially date back to the Early Bronze Age, have been discovered (cf. Wilkinson 2004: 76-78). This suggests that either the zone of grape cultivation was considerably larger in antiquity than it is now, or else that urban communities located beyond the zone of cultivation were nevertheless able to import sufficient quantities of grapes to produce their own wine in quantities that were sufficient to justify the costs of importation.

4.2.2: Early Bronze Age pastoral economies. In addition to growing cereals and cash crops, the Early Bronze Age peoples of Upper Mesopotamia were also keen pastoralists. Throughout the region, sheep and goats (referred to in combination as “ovicaprids”) were by far the most numerous domesticated animals at most sites during the EBA. Cooper (2006: 38) notes, for example, that ovicaprids consistently had the largest representation in EBA faunal assemblages from sites along the Syrian Euphrates, and in some sites accounted for as much as 75% of the total faunal population, with smaller numbers of pigs and cattle comprising most of the remainder of the domestic faunal assemblage at many sites. The ubiquity of ovicaprids in faunal assemblages is a reflection of their versatility as a pastoral resource. Like cattle, sheep and goats provide milk and hides as well as meat; however, they provide the additional secondary product of their hair and/or wool, which is used in the production of textiles (cf. Sherratt 1981, 1999).

Whereas cattle and pigs were generally kept in the immediate vicinity of settlements, it seems that many ovicaprids flocks were seasonally pastured in open

steppes or riparian valleys, which were sometimes at considerable distances from urban centers (Cooper 2006: 39). As temperatures in southeastern Anatolia can easily exceed 40°C during July and August and drop below freezing in the winter, climate appears to have been an important factor in shaping the development of herding traditions among the nomadic and semi-nomadic pastoralists of the Upper Mesopotamian steppes and mountains. In order to avoid the worst extremes of seasonal weather, and to take advantage of the best pastures during each season, local herdsmen moved their flocks of sheep or goats in an annual circuit of migration. This mobile pastoral strategy is attested by historical sources reaching back to the Bronze Age (cf. Rowton 1973, 1974), and also remained the standard mode of pastoralism in much later historical periods, for instance during the Seljuq period (cf. Finkel 2005: 6).

A serviceable modern example of this practice comes from the modern village of Cümçüme in the Turkish Euphrates Valley: in winter, sheep and goats at Cümçüme were penned in stables and hand-fed barley, and wheat and lentil chaff; these herds were then moved to the highlands in the early spring, before being left to graze on stubble fields outside of the village by July, where they stayed until being moved indoors once again in the winter (Wilkinson 1990: 57). Although it is likely that each individual circuit was developed uniquely with consideration to variations in local geography, climate, and so on, the pastoral system of annual herd migrations was probably widespread in southeastern Anatolia in ancient times, as in more recent historical periods (cf. Ur and Hammer 2009).

One interesting detail which emerges from the Cümçüme case is that even nomadic pastoralists groups appear to frequently rely on cereal crops – and thus, upon the presence of settled agricultural communities – in order to maintain their herds, at least to a certain extent. In the case of modern bedouin peoples in Syria, Wilkinson notes that among pastoralists living between Aleppo and the Euphrates, “sheep belonging to bedouin groups consume a significant amount of cereal crop residues,” and that Bronze Age pastoralists in the Syrian Euphrates Valley probably also utilized these agricultural resources, albeit probably not as heavily as modern bedouin do (Wilkinson 2004: 53). This relationship between settled farmers and nomadic or semi-nomadic pastoralists should not be misconstrued as one in which the latter were solely dependent on the former; modern bedouin living in dry areas with comparatively little agriculture simply graze their flocks in open pastures instead of fallow or harvested fields, should the latter be unavailable (*ibid*). And for their part, farmers in modern-day Cümçüme allowed animals to graze on stubble fields during the summer in part because their dung is a very useful fertilizer, and helps to replenish nutrients in the soil (Wilkinson 1990: 54). It is therefore likely that a mutual dependence developed between settled farmers and nomadic or semi-nomadic herders, perhaps similar to that which emerged in ancient northern Eurasia, where “paired economies [between sedentary and nomadic peoples] developed over time, so that initial contact gradually developed into sustained interdependence, with a strong degree of economic specialization on each side” (DuBois 1999: 16).

While this system was beneficial for nomads because it provided them with access to stubble fields in the winter months and markets for trade, a chief benefit for urban centers was that many of the herds that were tended, whether by settled farmers or by enclosed nomadic groups, were actually the property of civic bureaucracies. For example, the administrative records of Tell Beydar (ancient Nabada), a minor city located in the Upper Khabur Basin, has shed new light on EBA pastoral strategies employed by Upper Mesopotamian urban centers (Sallaberger 2004). Sallaberger reports that the city authorities owned 11 flocks of “regular” sheep and 7 of “regular” goats – that is, sheep and goats which were purposed for secondary products instead of being expressly fattened for their meat as offerings – with a total population numbering somewhere in the vicinity of 7400 animals (2004: 20). However, this figure does not include a much smaller population of ovicaprids that were deliberately fattened for feasting and sacrificial purposes. These animals were segregated from the rest of the population, presumably in the stables to the north of the administrative building known as the “Official Block” from which the tablets were recovered (*ibid*: 21).

The Nabada archives also indicate that the non-sacrificial ovicaprids were pastured somewhere outside of the city, rather than being penned in stables and grain-fed, and were in fact not permitted to enter within the central area of the site at all, even for official inspections or for the annual plucking of their hair or wool (*ibid*). It is unclear whether these animals were left to graze in nearby stubble or fallow fields, or were herded into more distant pastures via an annual migratory circuit similar to

that used by Anatolian herdsmen. What does seem clear, however, is that the daily diet of the majority of ovicaprids was not rigorously controlled by the city administration throughout the year, and may have included a combination of wild and domesticated plants, depending on where the animals were grazing at a particular point in time.

While much is known about the urban elite of aristocrats and bureaucrats (see below), there remains a tantalizing question which is not fully understood: what role, if any, did the nomadic or semi-nomadic pastoralist population played in civic administrative life? Unfortunately, despite the fact that at times these tribes played a key role in major historical events – as in the case of the Gutian invasions which destroyed the Akkadian Empire – apart from the details provided by modern ethnographic analogies or ancient administrative texts, the precise role of nomadic pastoralists in Early Bronze Age economic and political life is not well understood. As a result, the discussion that follows will draw heavily on archaeological and historical information for later periods of ancient Mesopotamian history, or from modern ethnographic analogies.

In general, what is known about the nature of nomadism in Bronze Age Upper Mesopotamia does not appear to fall in line with many standard assumptions about the character of nomadic societies. For one thing, as Rowton has convincingly shown, “the usual distinction between the realm of the nomad and that of the sedentary does not apply,” because pastoral land was so often “encircled by urban settlement, either partly or completely; the grazing lands visited by the nomads constituted enclaves

partly or completely within the sedentary zone” (Rowton 1974: 1). This kind of nomadism is called “enclosed nomadism” – a form of fully nomadic lifestyle in which tribes, while largely autonomous, were nevertheless partly or fully integrated into the social, economic, and political structures of the sedentary communities in their midst (*ibid*: 2). Thus, unlike their later counterparts, the nomadic Bedouin, who were able to exploit the domestication of the camel in order to achieve political isolation from settled societies if they wished, linkages necessarily developed between these early nomads and their sedentary urban counterparts (*ibid*). As a result of this, in parts of Upper Mesopotamia and Persia, interactions between urban centers and nomadic tribes occasionally developed into a rather unusual form of sociopolitical organization that is known as a “dimorphic structure” (Rowton 1973: 202). Polities which were organized along dimorphic lines would include “nomads as well as sedentary, and also a tribal as well as a nontribal population” within the same political system (*ibid*: 203), a pattern which continues well into modern times as evidenced by modern examples in southeastern Turkey (cf. Rowton 1974) and Iran (cf. Potts 2014).

Admittedly, there is no direct evidence for the existence of any dimorphic polities in 3rd millennium Upper Mesopotamia. However, this is a good example of a Middle Bronze Age dimorphic kingdom is the early second millennium state of Mari in what is today northeastern Syria. The man who was arguably the most powerful independent ruler of Mari during the Middle Bronze Age, Zimri-Lim, was acknowledged as king not only of the city and territory of Mari itself, but also as the ruler of a confederation of myriad nomadic peoples as well (*ibid*: 212). These tribes

maintained varying degrees of local autonomy, with some, such as the Jaminites, having their own tribal leaders that were allowed to call themselves “kings” of their own people (*ibid*: 213). In general, the autonomy of nomadic tribal groups appears to have been an accepted and important component of statecraft in dimorphic kingdoms. Rulers who attempted to undermine this arrangement could expect trouble; when Zimri-Lim, for example, attempted to exercise a greater degree of control than his predecessors had over the Jaminites, they rose in revolt against Mari to preserve their autonomous status (*ibid*: 214).

4.2.3: Anthropogenic impacts of agriculture upon Upper Mesopotamian paleoenvironment during the Early Bronze Age. From a myriad of archaeological evidence of human impacts on ancient landscapes and ecologies across northern Mesopotamia, it is clear that that there were environmental consequences to the rapid urbanization and agricultural development of the region during the Early Bronze Age. It is generally accepted that the spectacular expansion of Upper Mesopotamian urban settlements and their agricultural subsistence economies during the Early Bronze Age took a significant toll on the environment. Although the Upper Mesopotamian archaeological record provides little in terms of concrete paleoclimate proxy data, excavations throughout the region have uncovered a substantial body of evidence that demonstrates the negative effects of anthropogenic activities upon local ecosystems during the Early Bronze Age.

Deforestation appears to have caused a great deal of environmental damage throughout Upper Mesopotamia. Recent studies have shown that it is unlikely that

desiccation alone could account entirely for the disappearance of forests from the region, as even under comparatively arid modern-day climate conditions it would be theoretically possible for woodland to exist in Upper Mesopotamia “under the absence of human impact” (cf. Deckers and Pessin 2010: 216). It is, therefore, almost certain that the conversion of oak forests into the *jazirah* that is now widespread in the region was brought about through a combination of natural and cultural processes, rather than being solely caused by an episode of drought.

It is likely that the deforestation of northern Mesopotamia, which probably reached its peak during the middle centuries, resulted in permanent ecological transformations that affected both natural and human social systems. In areas that are characterized by semi-arid climate, “savanna turns less easily into woodland after the [processes] that created it have ceased”, because “the existing trees monopolize the water-supply, [and] it is difficult for new trees to arise between them” (Grove and Rackham 2001: 193). Thus, human activities that are so often concomitant with urban expansion, such as land clearance, overgrazing, or the clear-cutting of tracts of forest to obtain timber for building or other uses, may ultimately have resulted in the permanent elimination of large areas of native forest by the end of the Early Bronze Age (cf. Pournelle in Algaze *et al.*, 2001). And although the subsequent expansion of open grasslands was more suitable for cultivation than woodlands in the short term, it was, in all probability, also more vulnerable to degradation as a result of human misuse or natural processes, such as erosion, flooding, or drought.

4.3: Increased Sociopolitical Complexity and Economic Specialization

The dramatic urban expansion described above was not the only major social transformation to take place in northern Mesopotamia during the Middle EBA. During this time, those same societies also began to exhibit unmistakable signs of economic specialization and social stratification. These processes are generally seen as two of the hallmarks of this period, and it is not possible to understand the development of Early Bronze Age polities prior to 2200 BC without addressing them.

4.3.1: Craft specialization in the EBA. In Upper Mesopotamia, the middle centuries of the 3rd millennium (i.e., 2700-2200 BC) were a time of rapid advancement in economic specialization. It is likely that this development co-evolved with the emerging networks of long-distance trade and interaction that by 2500 BC had connected a vast area of the Old World stretching from Afghanistan to the Adriatic (which will be discussed in Chapter 5). The reason for this is simple: as these networks expanded and their social and economic importance among participating polities increased, the need to supply products which could be exchanged for desired foreign goods would thus have grown commensurately to meet the increased demand for those imported commodities.

By the second half of the millennium, if not earlier, Upper Mesopotamian urban centers were supporting numerous full-time craft specialist occupations. These professions included, among others, potters, metalsmiths, glazers, stonecarvers, weavers and other textile producers, and not least, scribes (cf. Moorey 1994; also Cooper 2006: 164-201). There are so many of these industries that it is not possible to

discuss them all here. Instead, I will focus on two of the more important ones that are especially pertinent here: ceramic production and metalworking. These industries are relevant both because their products were at the heart of the trading system, and also because they required large amounts of wood to burn as fuel during the production process, and thus had the largest potential to have a deleterious environmental impact on the landscape.

Throughout the Eastern Mediterranean, the Early Bronze Age was a period of mass ceramic production. At the beginning of the millennium, pottery production in northern Mesopotamia was largely a household activity (Moorey 1994: 157). But as cities expanded, increasingly – especially after 2500 BC – ceramic production became a standardized, “industrialized” affair (*ibid*). Interestingly, although ceramics appear to have become largely mass-produced as the millennium wore on, the quality of many wares appears to have declined from those of the Late Chalcolithic, a phenomenon shared with many comparable processes elsewhere, while the decoration of many (though by no means all) wares became far less elaborate (*ibid*).

Likewise, the importance of metalsmithing became increasingly central to production economies over the course of the millennium, eventually establishing itself as the premier form of professional craftsmanship (Cooper 2006: 166). To judge from the myriad finds of molds and other accouterments of metal casting, it seems likely that this particular skill was especially prized. At Tell Brak, for example, finds of limestone and sandstone molds used to cast metal disc ingots, weapons and tools, and some curious “trinkets” in the shapes of zoomorphic or anthropomorphic figures

demonstrate the importance of metal casting, especially during the later phases of the city's Early Bronze Age occupation (cf. McDonald and McDonald *et al.*, in Oates *et al.*, 2001: 247-248). The case of Tell Brak is fairly typical; cast objects like these are fairly common in EBA northern Mesopotamian sites (cf. Cooper 166-167). Cooper argues that one of the more prominent centers of metal production in the region seems to have been the Birecik-Carchemish Corridor (*ibid.*: 167). Whether or not this was the case, it is certainly true that this area has thus far yielded an unusually large number of metal objects – particularly personal adornments such as copper, bronze, and silver pins – in burial assemblages dating to the Early and Mid EBA (locally known as EB I-II; cf. Stork 2014).

It is worth mentioning that it was not just patterns of production that changed during this time, but also those of consumption, as well. During the Early Bronze Age, the production of *things* took on a new importance for many polities in northern Mesopotamia (and indeed, across much the Eastern Mediterranean Basin). This was partly an artifact of the rapid spread of new technologies during the period, notably bronze-working and, near the end of the millennium, the potter's wheel. But these developments were also made possible by another development that occurred at the same time: the rise of stratified, hierarchically organized complex societies. Without the advent of administrative management of labor – itself made possible in large part by the adoption of the cuneiform script from southern Mesopotamia – and the patronage of powerful and wealthy elites, it is unlikely that craft specialization would have developed as it did during the Early Bronze Age. Conversely, as I will explain in

the next chapter, the importance of trade, through which valued objects could be acquired, would also, in time, prove to have profound consequences for many polities in the region as the millennium drew to a close.

4.3.2: Social stratification during the Early Bronze Age. As noted above, in addition to a flowering of craft specialization, the Early Bronze Age also saw the establishment of stratified societies all across northern Mesopotamia. Like many other archaic states, one of the most telling signs of social stratification in northern Mesopotamia is the presence of monumental architecture, which proclaimed the power of the ruling elite in stone or mudbrick. The most important of these structures in a given Early Bronze Age city would nearly always be the palace, and to a lesser extent, the temple(s) – although, as Postgate has noted, “as one moves up river [from southern Mesopotamia] towards the hills the central role of the temple seems to diminish” (1992: 140). There are numerous examples of Early Bronze Age palaces in northern Mesopotamia, including the so-called Palace G at Ebla, the palace of Mari, and the Naram-Sin palace at Tell Brak. These palaces, and especially their public ceremonial spaces, were often lavishly decorated with painted scenes, stone and shell friezes, or exquisitely crafted objects made of precious materials (*ibid*: 143).

The presence of elaborate tombs with rich grave goods, which were constructed for what were presumably elite members of the community, is a further indication that this period was marked by increased sociopolitical complexity. This was certainly the case at Ebla, where “the distinction between royal and commoner was perpetrated not only by certain norms and practices within daily life, but also

through funerary practices” (Cooper 2006: 262), and was also a typical aspect of mortuary ritual at many other sites in the region, such as Tell Banat (cf. McClellan and Porter 2009) and Umm el-Marra (cf. Schwartz *et al.*, 2006).

The grave goods recovered from tombs in an elite mortuary complex at Umm el-Marra, a small urban center in the Jabbul plain of western Syria situated between Ebla and the Euphrates, are a good example of the richness of these elite burial caches. These include ivory combs (Schwartz *et al.*, 2006: 613), gold and silver jewelry (*ibid*: 615-616), and a number of silver drinking vessels (*ibid*: 619). These tombs were also well supplied with foodstuffs. Tomb 5 from this complex contained “sheep/goat segments with occasional cut marks, bird bones (duck, geese), and several species unattested in the other tombs (hare, pig, fox)” (*ibid*: 607), while Tomb 6 yielded a number of caprid bones, which appear to be the remains of “cuts of meat from three to four animals, sometimes with evidence of cut marks” (*ibid*: 609). These remains are a testament to the importance of communal feasting ceremonies as a form of elite display – a topic that I will revisit in more detail in the next chapter.

4.3.3: Patterns of kingship in Early Bronze Age Mesopotamia. An important aspect of the multicausal model proposed in Chapter 11 is the social consequences of the loss of political legitimacy by the rulers of Tiriş Höyük in the face of various setbacks. Accordingly, it is important to briefly consider the basis upon which the legitimacy of political authority rested in Early Bronze Age Upper Mesopotamia. Perhaps the ultimate expression of social stratification in early societies is the establishment of hereditary kingship. Texts from the Early Bronze Age

leave no doubt that this form of early monarchy was in place in Ebla, Mari, and many other cities. The nature of kingship in ancient Mesopotamia, however, was somewhat different from that which evolved later in pre-modern Europe, and for this reason it is worthwhile to examine it in a bit more detail here.

Much of our information about the nature of kingship in the north during this period is based upon the documentary record of the Sumerian and Babylonian south. Prior to the emergence of the Akkadian Empire in c. 2350 BC, there were two “tiers” of ruler in southern Mesopotamia (cf. Postgate 1992: 28-32). The lower, more common tier was the *ensi*, who was the ruler of a given urban center. Above this title sat the *lugal* (literally “big man”), an honorific that modern scholars often see as the equivalent of “king.” This title was successfully claimed only by more powerful rulers, who could expect to be accorded a certain amount of authority even by less powerful *ensi* (*ibid*).

In Early Dynastic southern Mesopotamia, deities were seen as the primary actors in the universe, and the ambitions of all human beings, no matter how politically powerful, could only be fulfilled if approved or tolerated by the gods (cf. Jacobsen 1977 [1946]: 185). Accordingly, larger political questions were also considered a matter for divine judgment. During the Early Dynastic period, therefore, powerful deities were believed to exert a direct and decisive influence over the political fortunes and activities of city-states (cf. Liverani 1995: 2355-56).

As Heinz notes, the role of the gods in politics was so central during the Mid EBA that “religion was the major parameter used to legitimate actions in these

societies” (2007: 80). The establishment of a border between the Early Dynastic cities of Lagash and Umma, for example, was described in one contemporary account (as reported by Cooper): “Enlil, king of all lands, father of all the gods, by his authoritative command, demarcated the border between [Lagash] and [Umma] [. . .] Mesalim, King of Kish, at the command of Ishtaran, measured [the border] off and erected a monument there” (Cooper 1986: 54). Because kings like Mesalim were seen in the Early Dynastic worldview as the political instruments of the gods, this provided them with a claim to legitimate authority as the earthly representatives of divine will who served as intermediaries between the gods and ordinary people. To cement this exalted earthly status, rulers often claimed to consort with important deities, or, more rarely, to be descended from them (e.g. Michalowski 2008).

Thus, in Early Dynastic Mesopotamia, kings occupied a kind of intermediate cosmological space that bridged the human and divine worlds. Importantly though, it seems that though they bridged the earthly and supernatural realms of existence, Early Dynastic kings were not considered to be living gods in their own right (Cooper 2008: 261).¹⁵ The distinction between supernaturally empowered, semi-divine kings and gods is crucial; because kings were the tools of the gods, the notion of a fully-divine king clashed with the unique liminal position that rulers claimed to occupy in the Early Dynastic cosmological order.

While occupying a semi-divine position provided the ideological basis for the political legitimacy of Early Dynastic kings, at the same time this ideology also

¹⁵ It was not until the reign of the fourth Akkadian king, Naram-Sin, that kings would begin to pronounce their own personal divinity.

limited their personal authority to a considerable extent. Because Early Dynastic kings acquired their agency from their role as the political tools of the gods, they were expected to behave according to divine instructions, and to carry out the wishes of their own divine masters. Failure to do so would result in the loss of divine favor, which could have serious temporal repercussions, both for the ruler and his subjects. Thus, the pious obedience of kings to the gods (and the impious behavior of their enemies) was a common refrain in Early Dynastic political propaganda.

A good example of this kind of propagandistic discourse can be found in Magid's analysis of the so-called "UruKagina Reform Text", which was commissioned by UruKagina, the last native pre-Sargonic ruler of the city-state of Lagash:

The [UruKagina Reform] text opens with a list of building projects that *UruKagina conducted on behalf of different gods*. It then recounts a number of alleged abuses from bygone days. Inter alia, UruKagina inveighs against the state, of yore, for levying grain taxes on certain priests; against funereal professionals for extracting hefty fees from mourners; and against wealthy persons for exploiting poor ones (by forcing them to dig wells and do other irrigation work on their fields). Most damningly, however, *he indicts his own predecessors for appropriating the property of the gods* - their plow animals, their choice fields, and their grain. This last and most striking accusation is generally regarded as evidence that UruKagina was a usurper. In this light, *the Reforms are seen as a special plea for legitimacy*. (Magid 2006: 8, *emphasis added*)

In the UruKagina Reform Text, it is clear that UruKagina's propagandists took great pains to demonize his predecessors as impious and arrogant, while at the same time depicting the king himself as an obedient servant of the gods – and, by extension, as a ruler who was the very embodiment of the traditional Early Dynastic

image of kingship. It is notable that the most serious charge listed in the text was that in appropriating the property of the gods for themselves, UruKAgina's predecessors acted as if *they* were divine.

The implication of the complaint is clear: in effect, the rulers of Lagash forgot their place as the subordinate instruments of the gods, whereas UruKAgina knew his place, and carried out the wishes of deities that entrusted him with important tasks. In this way, the usurper was portrayed as being the "legitimate" ruler, because he understood his role as an agent of the gods upon earth. Indeed, UruKAgina appears to have taken great pains to demonstrate that, unlike earlier kings of Lagash, he did not strive for that which was the exclusive privilege of divine beings. UruKAgina's claims to legitimacy, then, were embedded within the Mesopotamian understanding of the rights and limitations of Early Bronze Age kings, and his propaganda clearly reflects what we assume to be a widespread belief: rulers who failed to follow the commands of the gods could lose their divinely-lent authority to other potential instruments deemed more worthy of the gods' favor.

If the textual accounts concerning the characteristics and duties of kingship at Ebla (as described in Archi 2000) can be considered representative of kingship in northern Mesopotamia generally, then it seems the political and ideological basis of kingly authority was rather similar to that of the Sumerian south. (Indeed, the Sumerian word for king, *lugal*, serves as a loan word in Eblaite texts that is used to mean "lord," while the Sumerian for "lord," *en*, at Ebla meant "king" (Milano 1995: 1221).

However, there are a few interesting features of Eblaite kingship that deserve mention here. The Eblaite texts indicate that many details of governmental administration, such as the delivery and redistribution of goods, were overseen not by the ruler but by a minister, or vizier. This official was, in effect, the “prime minister” of the Eblaite state, and to judge from the texts, wielded a considerable amount of political power in their own right. In addition, other so-called “lords” (*lugal-lugal*) also held offices of states that were apparently of some importance, albeit less so than the office of minister/vizier. Thus, while kings at Ebla were indeed the heads of state, there were other figures whose duties insulated the monarch from the daily workings of the bureaucratic machinery of the state, but as a result appear to have also been invested with some measure of agency in determining state policies.

The Eblaite system of government is interesting, because that this city-state appears to have held hegemonic overlordship of smaller city-states in the Syrian Euphrates, especially to the west of the Balikh-Euphrates confluence (cf. Archi 2001), it is quite possible that the political and administrative structures of those polities were modeled, at least in part, upon the Eblaite system. If this was so, then given the regional political and economic importance of Ebla in the Upper Syrian Euphrates Valley, it is also potentially the case that Titiş Höyük employed a similar bureaucratic structure. Unfortunately, we possess no textual evidence from Titiş that might shed light on this, so for the present at least this must remain a matter of conjecture.

4.3.4: Secular and religious bureaucracies. One of the ways that the ruling elites of Early Bronze Age northern Mesopotamia were able to cement and legitimize

their authority was through control over the new technology of writing. Many of the everyday “secular” affairs of state, such as agricultural production or the distribution of foodstuffs to laborers as wages, were coordinated and overseen by civil bureaucratic institutions in the name of the palace. These bureaucracies were frequently subdivided into separate departments that were responsible for various aspects of administration, and were staffed by a new and growing class of literate scribes who were responsible for things like labor management and economic record-keeping.

As the administrative records of sites like Ebla (cf. Pettinato 1981; Archi 2000, 2001) or Tell Beydar (cf. Sallaberger 2004) attest, the urban polities of EBA northern Mesopotamia civic administrations that were responsible for overseeing the economic and social affairs of the state. These bureaucratic organs were staffed by scribes who were trained to read and write in the cuneiform script, a writing system which was borrowed from southern Mesopotamia.

Like the nature of kingship, much of what is known about these institutions derives from the analysis of texts from southern Mesopotamian sites. The organization of Early Dynastic administrations in this region seems to have been variable from city to city. However, the organization of the civic bureaucracy in the city of Šurruk (Fara) was, for the most part, probably typical. There may have been some centralization occurring at the local level during the Early Dynastic; as Visicato explains: “[r]ecently it has been suggested that the tablets were drawn up, in the majority, by a single central administration, which, through a complex capillary

organization, managed all aspects of economic and political life and connected hierarchically a series of organizations” (Visicato 2000: 19). It seems that the records of the city were organized in a linked system of “departments,” if the distribution of texts uncovered at Fara is any indication. According to Visicato, “The documents, because of contents or usage, were probably divided into various archives” (Visicato 2000: 20). Of these archives, he specifically mentions three of importance: the “Tablet House, [which] was considered to be the principal archive of the institution, where lists of barley rations, records of land allotments, and records of animals and carts for agricultural work were kept” (*ibid*), Site XVIIc,d, which was “probably a military administrative center, dealing with such activities as the recruitment of soldiers” (*ibid*), and Site IXaa, which was “probably a scribal center; the documents include administrative texts, lexical texts, and literary texts” (*ibid*).

There is other evidence from the Šuruppak tablets that seems to support the suggestion that the administration of ancient Mesopotamian cities was divided along lines of function. The names of individual scribes have been associated with three different categories of texts: scribes “mentioned only in contracts”, those “mentioned only in administrative texts”, and those “mentioned in various document types, including lexical texts” (Visicato 2000: 23). Scribes appear to have been assigned specific roles within the bureaucratic machinery of Šuruppak, with some perhaps having had a more versatile role than others. It seems likely, then, that the role of scribes became increasingly specialized throughout the 3rd millennium, as bureaucracies grew and divided to fit the changing needs of growing polities.

In northern Mesopotamia, local administrative institutions were often housed in monumental administrative buildings or so-called “palaces.” For example, excavations at Ebla, the capital of the most powerful independent polity in EBA Syria, uncovered a substantial archive of documents inside the remains of the monumental structure dubbed Palace G (cf. Pettinato 1981; cf. also Akkermans and Schwartz 2003: 235-39). The same was also true of the cache of texts concerning pastoralist resources at Tell Beydar, which were found in an administrative complex dubbed the “Official Block,” which was probably also the headquarters of the civic administrative departments that oversaw agricultural activities (Sallaberger 2004: 13).

4.3.5: Administrative management of the political economy. Two aspects of Early Bronze Age administrative management are of importance to the model put forward in this study – redistribution and management of fluctuating pools of labor – and thus these require a few words of explanation. Civic bureaucracies were primarily responsible for managing many of the economic activities of the state. Given that redistribution was the basis of virtually all Early Bronze Age civic economies in the ancient Near East, one of the primary functions of these bureaucratic organs was to oversee the collection and redistribution of agricultural surpluses and other products managed by the state. Economic records and other documents from this period attest that this form of organization was certainly ubiquitous in both Upper and Lower Mesopotamia during the Early Bronze Age (cf. Postgate 1992: 237-40; also Foster 1982; Sallaberger 1996). For instance, records of Late EBA (in this case Sargonic) date obtained from the Sumerian city of Umma indicate that workers were given

rations of grain every 4-5 days, in addition to being fed daily rations of prepared foods, bread, and beer by the authorities (Foster 1982: 25). Moreover, by the reign of the Old Babylonian ruler Hammurapi (c. 1792-1749 BC), grain was legally enshrined in some cases as a standard for fixing the value of other goods or services in transactions between private individuals, although it is unclear whether the practice was accepted during the Early Bronze Age (cf. Postgate 1992: 196, Text 10.5).

A common feature of Mesopotamian rationing systems was that the size of grain rations were based upon the rank and position of the recipient, as is attested by administrative texts from Tell Beydar (Sallaberger 1996: 94; 99-102). Not surprisingly, higher-ranking members of the community were accorded a greater share of the agricultural harvests and surpluses as an indication of their social status. Moreover, many of these persons were not actually involved in farming. Some of the higher-status individuals who appear in the Umma rationing accounts, for example, were full-time specialists with other occupations, such as soldiers or court musicians, who benefitted from the agricultural production of the state but played little or no role in production of food (cf. Foster 1982: 19). In this sense, therefore, the civic bureaucracy was performing two different roles at the same time: doling out rations and other entitlements to the citizens, while simultaneously reifying the hierarchical social structure of the state through the disbursement of rations.

Apart from managing the collection and redistribution of resources, another major task of the bureaucracy was the management of the city's labor pools. Early states generally required large pools of available labor in order to function efficiently,

but also consequently had to be able to protect and provision workers. Many building projects undertaken by archaic states required large numbers of laborers. Examples of such projects include agricultural works, such as irrigation or terracing, and monumental buildings like temples and palaces. As cities grew larger and their economies more specialized, the demand for more low-skilled labor became greater, while the local labor supply dwindled as other economic roles were occupied. And if the labor pool should become depleted thereafter, this could have created numerous problems for the state – a point that I will return to in my discussion of the multicausal model for Tiritiş Höyük’s political collapse in Chapter 11.

Additionally, there are some grounds for supposing that life in an urban center was a potentially dangerous prospect for rural immigrants in Early Bronze Age Mesopotamia. Early cities were, in general, extremely unsanitary, leading to their description as “undoubtedly heavily polluted with all kinds of rotting organic matter and human waste” (Akkermans and Schwartz 2003: 78). Poor sanitation, and the close proximity of humans, domesticated animals, and other vectors for disease must surely have made cities ideal breeding grounds for a wide range of viruses and bacilli (Diamond 1987). In his 1976 work, *Plagues and Peoples*, William McNeill describes life in early cities as a struggle to combat a process of urban attrition: “patterns of human reproduction had to adjust to the systematic loss of population that resulted from exposure to diseases that flourished under civilized conditions” (McNeill 1976: 80).

Given all of these hazards, it has been suggested that immigrants were often needed to sustain the population of early cities, especially as economic specialization increased. If this was the case, a given early city's population was probably in a constant state of flux, with attrition leading to high death rates, and new immigrants coming in from the countryside to refill the labor pool (McNeill 1976: 80-81). Maintaining the necessary labor pool through immigration was, therefore, a constant problem for early city administrators to juggle, and often they were not successful at managing the problem (McNeill 1976: 84).

On the one hand, overpopulation would be a drain on agricultural and other resources that could potentially unbalance the social system if there was famine. On the other, maintaining a population of sufficient size for increasing economic specialization was a necessity if the city was to profit economically through trade and agricultural expansion. This dilemma would be compounded further if the city became incorporated into a larger political body, such as the Akkadian empire, which demanded a constant stream of resources into the state treasuries from subjugated cities (see, for example, the case of Sargonic period Umma in Foster 1982: 147).

City authorities apparently solved the problem of keeping urban population levels steady in a number of different ways. One solution was to create more opportunities for employment, which would keep a flow of job-seeking immigrants coming into cities, but which also created the potential of depopulating of the rural periphery around those centers (Santley and Alexander 1992: 35). The purchase of slaves – a commodity both valuable and readily obtainable, much to the distaste of

most modern scholars – was another solution. A third strategy, albeit one available only to large and powerful states, like the Neo-Assyrian Empire of the Iron Age, was to forcibly deport populations across the landscape as the needs of economic production dictated (cf. Oded 1979).

Lower class laborers (wage-laborers or slaves) were probably the largest segment of immigrating populations, and it is likely that they were routinely brought into cities from elsewhere to assist in construction projects or other labor-intensive tasks, where by force or by inducement (cf. Heimpel 2009: 45, 48-52). However, this was by no means the only social class that appears to have experienced periodic relocations. By the early 2nd millennium, if not before, merchants often set up trading colonies in distant trading centers, from which they acted as long-term commercial agents for the interests of their native cities (cf. Postgate 1992: 212-216). Another kind of immigration that was common in Bronze Age Mesopotamia was the reassignment by large territorial states of middle-ranking officials – often drawn from families of “lower ranking core elites” – from core cities to administrative posts in the provinces (cf. Santley and Alexander 1992: 35).

Migrations could also be caused by political upheavals, especially wars. Thus, the sacking of cities during the late 3rd millennium BC – for instance, the apparent destruction of Ebla and Tell Brak at the hands of Sargon’s armies (Akkermans and Schwartz 2003: 278) – would certainly have forced refugees to emigrate elsewhere. As I will argue at the conclusion of this study (see Chapter 11), this may also have

been a problem for Titriş Höyük, and may have helped to hasten its economic and political decline during the Late EBA.

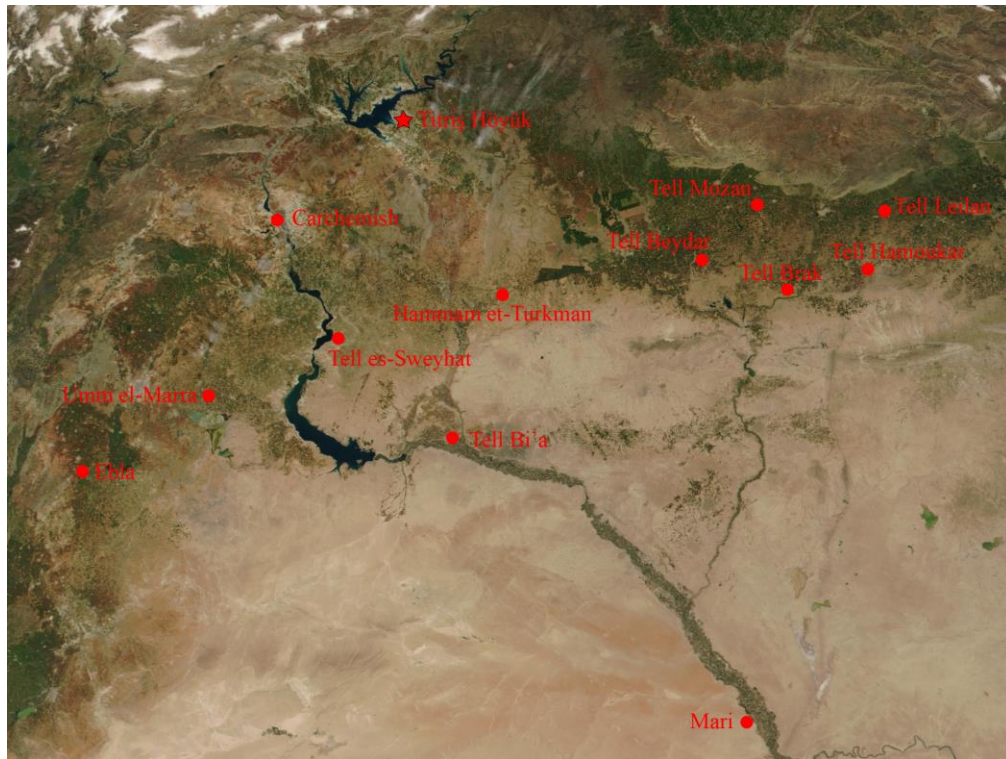


Figure 4-1: A map of northern Mesopotamia (courtesy of NASA) depicting the approximate locations of important Early Bronze Age urban centers discussed in the text.

Chapter 5: Long-Distance Trade and the Socioeconomic Development of the Early Bronze Age

A key element of the political economies of the Early Bronze Age was the development and spread of new ideas, fashions, and commodities via a series of interconnected networks of long-distance commercial exchange and interaction. As we shall see, the accumulation of luxury items – many of which were probably seen as being imbued with symbolic significance or supernatural power – and of esoteric knowledge was an essential component of strategies of legitimation for the emerging elite classes of many urban and proto-urban polities throughout the Eastern Mediterranean world during this period. It is not possible, therefore, to understand the economic history of this period (or for that matter, the social and political histories) without also understanding the nature of this interaction system, and how it affected the development of those polities who were its participants.

Although the histories of these polities are of course distinct, an overall pattern of change that took place throughout the 3rd millennium – and especially during its final three centuries – does emerge when considering the evidence from a broader regional perspective. To illustrate this pattern, I will show how trade and interaction helped to shape the developmental trajectories of Early Bronze Age polities not only in Upper Mesopotamia, but also throughout much of the Eastern Mediterranean Basin. I argue that the import of prestige items connected with communal bouts of feasting and drinking, personal adornment, and tin-bronze ingots and implements, influenced

the 3rd millennium cultural trajectories of socially complex urbanized polities in northern Mesopotamia, northwestern Syria, and beyond.

Finally, this chapter will close with an examination of the evidence for the disintegration of trade-based regional interaction in approximately 2200 BC. As I will argue in Chapter 11, the disruptions of these trade systems during the late 3rd millennium may have played a crucial role in the decline of Tiritiş Höyük. Accordingly, I will also review some of the arguments that have been proposed concerning the impacts of the cessation of exchange networks upon emerging complex societies in other parts of the Eastern Mediterranean, as these examples will help to inform my interpretation of the effects of trade disruption upon Tiritiş Höyük later in this dissertation.

5.1: Near Eastern Long-Distance Commercial Exchange Networks During the 4th and 3rd Millennia BC

In general, the study of long-distance commercial exchange in the ancient Near East is certainly not new to Mesopotamian archaeology, and has in fact received a great deal of scholarly interest and comment, particularly since the mid-1970s (e.g., Crawford 1973; Ekholm and Friedman 1979; Santley and Alexander 1992; Baines and Yoffee 1998). Consequently, a fair amount is known about the commercial transactions of cities and states in the region during this time, thanks largely to administrative records from Ebla and Tell Beydar, and to the presence of goods in burials that were clearly imported (e.g., Sertok and Ergeç 1999; Schwartz *et al.*, 2006).

5.1.1: Long-distance exchange prior to the Early Bronze Age: the Uruk

World System. Because long-distance trade is often seen as one of the key causes of the emergence and subsequent expansion of complex urban societies in southern Mesopotamia during the 4th millennium BC, it is instructive to first turn our attention briefly towards the development of a long-distance exchange system during this period before examining the nature and social value of long-distance interaction and exchange during the Early Bronze Age. During this period, a multitude of smaller settlements were abandoned at the same time as urban centers in the alluvial floodplains to the south, such as Uruk, Ur, and Eridu, experienced a major expansion (Adams 1981: 60), while at the same time, southern Mesopotamian architecture, ceramic styles, and administrative technologies such as cylinder seals also began to appear at sites as far away as southeastern Turkey and northwestern Iran (cf. Algaze 1993). Guillermo Algaze, a proponent of the trade-as-prime-mover perspective, has described the importance to Mesopotamian elites of acquiring commodities from long-distance exchange as follows:

A further social impact of the exchange patterns described for Uruk societies was that, once started, the continued import of exotic commodities would have become a strategic necessity for those engaged in the trade. The reasons for this have been explained by Mary Helms (1988, 1993), who uses a variety of ethnographic, historic, and literary evidence to show how, in traditional societies, exotic resources attesting to contacts with geographically and culturally alien culture are commonly imbued with ritual meaning and typically come to be seen as a direct demonstration of a leader's fitness to rule. Thus, the ability to acquire, display, and distribute exotic imports becomes crucial to the success of self-aggrandizing leaders in legitimizing their unequal access to resources and power. Those imports become, in short, central to the very reproduction of the social order. (Algaze 2001: 59)

Algaze's model for the rise of complex polities in southern Mesopotamia during the Uruk period, the so-called "Uruk world system," places long-distance commercial exchange as a central factor -- if not *the* central factor -- in the rise of emerging complex societies during the 4th millennium BCE. In the Uruk case, he argues, not only were preciousities such as gold and lapis lazuli important for ideological reasons, but so too are more mundane commodities, such as lumber and bitumen (Algaze 1993: 74-84). Wood, in particular, was essential as a building material for the massive religious structures that were erected by Uruk elites, because without this timber it would have been impossible to construct the roof to temples and palaces that both solidified and further enhanced the prestige and authority of elites (Algaze 2001: 51). The quantities of timber that were imported by the southern Mesopotamian polities from Syria and southeastern Anatolia are staggering: Algaze (2008: 97-98) estimates that to construct the monumental building in the Eanna and Kullaba (Anu) Precincts at Uruk during the later phases of the Uruk Period alone, somewhere between 16,800 and 33,600 linear meters of roofing timber would have been required!

5.1.2: The nature of EBA long-distance trade. Although the Uruk World System collapsed during the late 4th millennium, by approximately 2700 BC what might be termed an "EBA Interaction Sphere" had begun to emerge. Of the course of the next 500 years, this developed into a great chain of overlapping economic exchange and interaction networks stretching from the Indus Valley to the shores of the Eastern Adriatic Sea. Indeed, the word "chain" is an apt description for this

system, as exchange was for the most part conducted via peer-to-peer interaction, wherein goods were passed from one city to the next along established overland, riverine, or maritime trade routes.

A good example of such a network is the so-called Anatolian Trade Network, or Great Caravan Route, which connected a number of Anatolian and Aegean cities not only to each other, but also with other neighboring regions such as Cyprus, the Levant, and Mesopotamia (cf. Şahoğlu 2005). This trade network allowed for the transmission of goods from Mesopotamia and Syria, via the Samsat ford across the Euphrates near Titriş Höyük, to ultimately be obtained by urban centers on the Aegean coast of Anatolia, such as Troy and Liman Tepe, and vice versa (*ibid*: Fig. 1). This system of peer-polity commercial interaction was facilitated by both overland and sea-borne trade routes, which linked not only the Early Bronze Age cities of Anatolia and the Aegean to each other, but also indirectly to polities in Syria, Mesopotamia, Egypt, and even more distant places.

Of course, the Anatolian Trade Network was but one of several regional interaction systems, all of which were at most loosely interconnected. But if we consider this tangled web of peer-to-peer interactions as a single unit, which encompassed polities as far away as the Adriatic Basin and Central Asia, then in its totality the Early Bronze Age commercial interaction sphere can be thought of as a kind of early “proto-globalization,” in that many of the ruling elites who participated in this system shared a cosmopolitan, international elite culture. The term “globalization” is, of course, presently bound up with very specific modern

associations. However, if we put these aside in favor of Friedman's more general definition – a shared economic and cultural system that “entails the formation of international ‘communities,’ however loosely knit, that share common interests” (Friedman 1998: 245) – then for all their differences, the trading system of the Early Bronze Age does in fact have some commonalities with the modern globalized economy. In that sense, at least, the emergent elites of the Early Bronze Age – with their shared emphasis on cosmopolitan ideas and fashions, and their focus on competitive emulation through the acquisition of exotic personal adornments, fine ceramics (especially those associated with commensal feasting and drinking activities, or which served as containers for wine, oils, or other valuable liquids), and other luxuries that they conspicuously consumed and displayed – are not so very different from the contemporary “trans-national capitalist class” that stands at the top of the modern global capitalist system (cf. Sklair 2000). If, as Friedman argues, “[t]he cosmopolitanism of the elite is not modernistic” (1998: 245), then given the apparent centrality of foreign luxuries as a means of displaying elite status, this characterization certainly seems to apply to the Early Bronze Age.

5.1.3: The benefits of long-distance trade for EBA elites. A wealth of archaeological evidence suggests that the acquisition of exotic commodities, which Algaze argues was so critical to the development and maintenance of the Uruk period polities of the Mesopotamian alluvium during the 4th millennium BC, was also central to the formation of complex polities and hierarchical social organization in northern Mesopotamia, Anatolia, the Aegean Basin, and Cyprus during the 3rd millennium. As

was the case for the Uruk elites, Early Bronze Age elites hankered after small but highly valuable items like golden or precious stone personal adornments, which could be hoarded, ostentatiously displayed, or redistributed to signal their elevated status, or to secure the loyalty of followers or other important persons.

However, an important element of the EBA long-distance trade in exotic luxury goods that may be different from the Uruk period is that, insofar as we have evidence, many of the prestige goods which were imported by these polities are associated with feasting and drinking ceremonies (of which more below). These ritual events probably served as a means for elites to accumulate prestige and status through public displays of wealth – and, no less importantly, of their magnanimity through acts of public gift-giving. And because these were communal affairs, feasts probably also served as a non-violent arena for various elite persons and factions to vie with each other for status through a continuous process of competitive emulation (cf. the discussion in Broodbank 2013: 335-6).

An equally important if less material benefit of long-distance exchange networks was that they also allowed elites to accumulate so-called “esoteric knowledge” of foreign places, customs, and ideas that were imbued with symbolic meaning (cf. Helms 1988). Esoteric knowledge can take many forms, including, for example, information concerning the locations and characteristics of distant places believed to have cosmological significance. Thus, to possess this knowledge was, in a symbolic sense, to possess supernatural power.

Numerous ethnographic/historical case studies support Helms' argument that the foreign objects obtained via these interaction networks were probably seen as sources of symbolic or supernatural power. For example, in the period immediately after contact with Europeans, Hawaiian chiefs eagerly sought to acquire Western luxuries – so much so that, as Friedman puts it, “[t]he early literature on contact Hawaii indicates that the consumption of Western goods by the chief class was an all-consuming pastime” (1990: 325). This pursuit of foreign luxuries, however, was not driven merely by a desire to acquire exotica for its own sake; rather, because these objects these objects were perceived of as sources of *mana*, or spiritual power. The goal of the chiefly class, then, was “to identify as closely as possible with the *mana* which is embodied in such imports and which as such is simultaneously an accumulation of status (in our terms)” (*ibid*: 326). In other words, far from being a matter of hedonistic self-indulgence, the acquisition of foreign luxury objects was actually a matter of statecraft: the means by which elite groups could advance and legitimate their authority over others (at the expense of rivals).

In the Early Bronze Age Eastern Mediterranean world, one kind of esoteric knowledge, in particular, may have been especially significant: the seemingly “magical” ability to transmute useless lumps of tin and copper ore (which, in many cases, could only be obtained from abroad) into bronze (cf. Kristiansen and Larsson 2005: 56). Helms (1993) has convincingly argued that the ability to accumulate, control, and harness this sort of knowledge could serve as a powerful means of legitimating the authority of elites, who could cast themselves as possessors of

supernatural power, or as supernatural beings in their own right. Moreover, as it is likely that these objects were themselves seen as possessing symbolic significance or supernatural power – if only because of the “magical” means by which they were created – and therefore, the display of bronze adornments or other objects may well have been a doubly effective method of accumulating and reifying both individual prestige and the elite standing of one’s hereditary lineage.

Much of the evidence we have for luxury imports obtained via long-distance exchange networks has been found in burial contexts, which suggests that these goods were also a part of mortuary rituals. The idea that valuable luxury items would be “sacrificed” in funerary rites seems to be very much in line with the strategies of elite legitimation described above. For not only would the symbolic or supernatural associations of these objects imbue the deceased members of elite lineages with posthumous prestige, but the act of depositing these valuable commodities in burials also served as another kind of public conspicuous consumption. In this way, elite members of these societies could further enhance the already exalted status of their lineages, as well as their own personal prestige.

5.2: Archaeological Evidence for Long-Distance Exchange

A wide range of objects were traded in this exchange system. However, the majority of these can be lumped into three specific categories: finely-crafted ceramic and metal wares, particularly those used in ceremonial bouts of feasting and or drinking; personal adornments made from valuable materials such as precious metals

or (semi-)precious stones; and a range of metal ores, ingots, and implements. As I will explain below, all of these luxury items were, in various ways, significant to the accrual of status and power by EBA elites.

It is difficult to overstate the importance of commensal feasting and drinking ceremonies to the creation and legitimation of elite status and political authority in the Early Bronze Age Mesopotamian world. Iconographic depictions of feasts, often known as “banquet scenes” or “symposium scenes” (Pollock 2003: 22), occur in a variety of different forms, including cylinder seals and seal impressions, plaques associated with important or monumental buildings, and most famously, the so-called Standard of Ur, a wooden box inlaid with precious and semi-precious materials which depicts a military triumph of Ur on one side, and a banquet on the other (*ibid*: 24). Pollock notes that in “most of the feasting scenes, the consumption of drink, rather than of food, seems to predominate” (*ibid*), which suggests that the imbibing of alcoholic beverages was a particularly important social activity. Both men and women are frequently shown as participants in these affairs (*ibid*: 23-24), which appear to have been rather lavish occasions; attendants who wait on the participants are a common feature, while in some of the larger banquet scenes, like that of the Standard of Ur, musicians also performed during the festivities (*ibid*: 24). However, given that texts indicates the offering of wine, beer, or even water were important components of religious ceremonies (cf. Postgate 1992: 119-120) and funerary rites, and that a variety of ceramic and metal vessel types such as bowls, cups, and jugs were called for in these practices, it must also be noted that commensal feasting and drinking ceremonies

also appear to have more powerful symbolic associations with the gods or the underworld (Pollock 2003: 25). It is safe to say, given the symbolic connotations associated with them, that the acquisition of high-quality ceramic or metal drinking, eating, and serving vessels was not simply a matter of elites showing off, but rather a matter of much greater import for the maintenance of the social and ideological systems of these early urban communities. Accordingly, acquiring the objects which were needed for these important religious and social rituals – many of which needed to be imported from abroad, or could only be fashioned from imported materials – was an element of statecraft for many Early Bronze Age elites across a wide swath of the northern Near East.

In addition to the iconographic and textual evidence, the prominence of ceramic wares connected with these activities present in the Mid and Late EBA ceramic assemblages – especially as grave goods – further illustrates that the adoption of these ritual events as a form of social bonding was widespread. The high frequency of locally-made and imported drinking vessels, such as conical cups and goblets, in the ceramic assemblages of Amuq Phases I and J (cf. Braidwood and Braidwood 1960: 520; also Welton 2014), is further evidence that these communal ceremonies were also an important feature of social life on the northwestern coastal plain of Syria, as well as in the Euphrates Valley. Examples of imported ceramic vessels – particularly those which were associated with these communal festivities – have been found in numerous sites in the region. For instance, a “metallic-like” small bowl with elongated triangular decorations found in Early-Mid EBA levels at Tell es-Sweyhat (Sweyhat

Phase 4) was almost certainly imported possibly from the site of Tepe Gawra in northwestern Iraq (Holland 2006: 161). Akkadian period contexts at Tell Brak have yielded a small number of sherds of Black-burnished Early Transcaucasian (or Kura-Araxes) ware – a vessel type that was the primary form of ceramic in Eastern Anatolia and the South Caucasus during the 3rd millennium BC (*ibid*: 160-161).¹⁶

Some EBA ceramic vessel types appear to have gained a wide regional distribution because of their ceremonial function. For example, in the Upper Syrian Euphrates sector and the Birecik-Carchemish corridor, two drinking vessels, which are described as Red banded chalices and Sugar-loaf beakers (i.e., metallic ware cup), have been found at numerous sites. Red banded chalices, for instance, occur in EBA contexts in Gre Virike, Carchemish, Jerablus Tahtani, Tell Shiyukh Tahtani, Tell Ahmar, Qara Qosaq, Tell es-Swehat, and Habuba Kabira, among others (cf. Sconzo 2007: Fig. 17.7). At Dja'de el-Mughara, Shiyukh Tahtani, Sweyhat, and Gre Virike, both vessel types appear frequently in mortuary contexts (*ibid*: 254; 262-263). This strongly suggests an association between these vessels and funerary rites, although it is not clear whether these objects were solely purposed as grave goods, or whether they were also used in other ceremonial contexts (*ibid*: 263). Whatever the case may be, it seems clear that the Red banded chalice and Sugar-loaf beaker vessel types were connected with elite mortuary practices that were shared by a number of communities situated along the Euphrates River between Lake Atatürk and Lake Assad.

¹⁶ Whether or not these are evidence of direct interaction between Nagar and polities located in these distant areas is unclear.

Personal adornments and luxury household goods also appear to have been a commodity of considerable social importance. The monumental Palace G at Ebla, for example, has yielded numerous examples of luxury imports intended for display, including precious stone objects made of lapis lazuli, alabaster, and diorite – and even one alabaster lid with an Egyptian inscription (cf. Akkermans and Schwartz 2003: 239-40). At Tell Brak, beads made of imported materials such as frit, carnelian, and shell have been discovered in Middle EBA levels from the courtyard and monumental complex of Area FS (see McDonald 2001: Tables 8, 10, and 14, respectively).

Some ceramic vessels were almost certainly containers for other commodities such as perfumes, and thus these objects provide circumstantial evidence regarding the trade in cosmetics and other perishable personal adornments. For example, a number of so-called “Syrian bottles” dating to the mid-to-late 3rd millennium at Tell Brak (Nagar), which Oates believes were almost certainly manufactured in southeastern Anatolia, were probably containers for scented oils or other cosmetic substances (cf. Oates *et al.*, 2001: 159-160). Examples of Syrian bottles have also been found in the so-called “perfume room” at Shiyukh Tahtani (cf. Sconzo 2007: Fig. 17.11), and at other sites such as Gre Virike, Selenkahiye, and Tell Bi’a (*ibid*: 261). If these vessels were indeed primarily meant as containers for scented oils, then the wide distribution and high frequency of Syrian bottles in the Upper and Middle Euphrates suggests that these unguents were highly desired by elites in many Early Bronze Age communities situated along the Euphrates in Syria and Anatolia.

Another major component of Early Bronze Age trade, particularly after c. 2500 BC, was the exchange of metal ores, metal ingots, and metal implements, especially those connected with the smelting and cast of tin-bronze. Modern Syria possesses no substantial natural deposits of copper or tin, so clearly these metals were imported (cf. Montero Fenollós 1999: 444-446).¹⁷ Copper came primarily from Cyprus and from southeastern Anatolia – Montero Fenollós claims that the flow of copper from the latter source was controlled by Tell Mozan (ibid: 447). Tin came primarily from Central Asia (cf. Muhly 1993), although it may have been mined in Anatolia at Kestel (cf. Yener and Vandiver 1993), but this mine was located on the other side of the Taurus from northern Mesopotamia. Therefore, it follows that the many copper and tin-bronze ingots and objects found in Upper Mesopotamia were almost certainly imported, and were highly valued commodities. Because of its scarcity and usefulness, tin was especially prized; at the Syrian city-state of Ebla, its value was roughly equivalent to that of silver (Broodbank 2013: 336-337).

Despite the difficulty in obtaining copper and especially tin, tin-bronze objects have proven a common find in Early Bronze Age archaeological sites all over northern Mesopotamia. At Tell Brak, for example, Mid and Late EBA levels (locally known as ED III/Akkadian) yielded numerous examples of finished bronze and copper goods, including bowls and other vessels, various kinds of pins, cosmetic tools, needles, fishhooks, and several different types of weapons (cf. Oates *et al.*, 2001: 236-242).

¹⁷ Texts from Mari indicate that trade in “mountain copper” was being orchestrated by Carchemish during the early 2nd millennium, but whether this polity was trading in the metal during the Late EBA is far from clear (*ibid*: 445-446).

Numerous pins, tools, and weapons were also recovered from EBA levels at Tell es-Sweyhat (cf. Holland 2006: Appendix 6), while metal fragments and clay crucibles from EBA contexts (*ibid*: 237) indicate that at least some of these objects were crafted locally from imported copper and tin. In the Amuq, double-spiral pins also commonly occur in Phase I levels (Braidwood and Braidwood 1960: 520), which attests to the popularity of these objects in coastal northwestern Syria as well as the Syrian Euphrates Valley.

The contexts in which these metal objects have been found clearly suggest associations between metalwork and ritual. In the Mid and Late EBA, “burials from Euphrates River Valley sites [. . .] contain vast amounts of metalwork” (Cooper 2006: 167). This was not the case everywhere, however. At Tell Brak, although virtually no metal objects were part of funerary assemblages, some 37% of all Early Bronze Age metal objects found at the site – not only copper and bronze, but also gold and silver – were deliberately deposited into the fill of walls or floors within monumental public or religious structures (Oates *et al.*, 2001: 233-235).

5.3: Was the Decline of Long-Distance Trade a Cause of Political Collapse?

It seems clear that many of the sudden cultural transformations visible in the archaeological records of Eastern Mediterranean polities are temporally correlated with the waxing and waning of long-distance exchange networks. The system of international interaction and exchange that had flourished during the second and third quarters of the millennium, when urbanism and social complexity in northern

Mesopotamia was at its zenith, seem to have collapsed during the final quarter of the millennium. The Anatolian Trade Network, which linked Tiriş Höyük with other polities in Anatolia, appears to have disintegrated in approximately 2200 BC (Şahoğlu 2011: 177), as did the pan-Aegean maritime interaction network that was interconnected with it (Broodbank 2013: 350).

Although it is not typically given much thought as a causal factor of the regional decline of Early Bronze Age complex societies at the end of the 3rd millennium BC, there are indications that long-distance interaction and trade may have played an indirect role in creating, magnifying, and facilitating the spread of crisis not only in northern Mesopotamia, but across much of the Eastern Mediterranean. It is already well established that Early Bronze Age networks of long-distance commercial interaction provided many communities with access to valuable commodities and new technologies, and also helped to consolidate and legitimate the authority of emerging sociopolitical elites. But because long-distance interaction and exchange became thoroughly integrated into the social, economic, and even ideological fabric of many participating polities, these societies may therefore also have been made more susceptible to serious social and economic shocks when these networks eventually broke down in c. 2250 BC.

While there is a temporal correlation between the breakdown of the international trade circuit and the political collapse of polities in northern Mesopotamia, Anatolia, the Aegean, and other areas that were serviced by this system, how exactly these phenomena precipitated each other is less clear. A comprehensive

examination of this question lies well outside of the scope of the present study.

However, because they will have some bearing upon the multicausal scenario for the collapse of Titriş Höyük that I will propose in Chapter 11, there are two points that deserve further discussion at this point.

Given that the acquisition of prestige goods and other key imports formed part of the foundation of the social hierarchies of the period, it is conceivable that a loss of access to these socially-important items might therefore have undermined the position of elites, and the legitimacy of the prevailing hierarchical social system. We must also not forget that these feasting and drinking ceremonies were probably imbued with symbolic or religious significance. In this sense, then, it is a very real possibility that the failure of local elites to obtain socially and/or ideologically important luxuries after the international exchange networks began to decline could have resulted in a sudden loss of public confidence in the elite management of the polity. As Broodbank explains, “the most elaborate and rigid social structures of trade were most susceptible to collapse, both because the reputation of those at the top for effective organisation and intercession with the gods was compromised, and because their investment in the status quo gave them less incentive to initiate change” (Broodbank 2013: 349).

This problem was, in all probability, compounded by the nature of the exchange networks. As societies became increasingly involved in and reliant upon trade to maintain their own social systems, they also became more likely to experience serious consequences in the event of any significant disruption in the flow of commodities. But because the nature of the trade was peer-to-peer, participating

polities were mutually dependent upon each other to keep open the lines of communication and exchange. Thus, a major disruption in any part of the system could quickly have begun to affect the flow of goods to other polities, and in a sort of Early Bronze Age version of the “domino effect,” could therefore in turn have placed increased stress upon *their* social and economic structures.

While the collapse of international trade may have increased stresses, it is also possible that the regional and extraregional trade in bronze implements might have been indirectly responsible for the violent character of the upheavals during the end of the Early Bronze Age. Wiener has pointed out that in the Early Bronze Aegean, the “increasing availability and/or improvement in weapons” (2013: 586) made possible by the profusion of tin-bronze and tin-bronze smelting and casting technologies may have actually helped to encourage a shift from trading to raiding during the Late EBA.

I can see no reason why Wiener’s point about the impacts of bronze weapons and weapon-making technology in the Late EB Aegean would not also apply in northern Mesopotamia, or indeed anywhere in the Near East. As I discussed above, bronze weapons have been found in Mid and Late EBA levels of numerous sites in the region. Moreover, there is also a wealth of archaeological and paleopathological evidence for increased violence during the Late EBA (which is discussed in Chapters 4), including from Titriş Höyük itself (see Chapter 6), that provides further circumstantial support for this possibility. Bronze weapons and bronze-working – both of which were transmitted across the region via the same trade routes that provided access to other luxury imports – may therefore have helped to accelerate the

deterioration of the political and economic status quo in Upper Mesopotamia once the stability of the region was undermined. And, as I will argue in Chapter 11, the diffusion of bronze-working via long-distance exchange routes, coupled with the subsequent collapse of the trading system, likely helped to seal the fate of Tiriş Höyük during the Late EBA.

Chapter 6: The Early Bronze Age in the Karababa Basin

Having thus provided a summary of some salient regional Early Bronze Age cultural, economic, and political developments in northern Mesopotamia as a whole, I turn now to examine the archaeological evidence for those same Early Bronze Age developments within the Karababa Basin itself. During the Early Bronze Age, a number of human settlements of varying size and population density were scattered across the Karababa Basin. The largest of these archaeological sites is the focus of this study: Titriş Höyük, the dominant urban center in the area during the Middle and Late EBA. The site of Titriş Höyük is located roughly in the middle of the Karababa Basin, some 10 km southeast of the pre-1997 Euphrates channel (but only a short distance from the shores of the artificial reservoir, Lake Atatürk). Apart from Titriş, the Karababa was also home to a number of smaller contemporary sites, of which Gritille Höyük, Lidar Höyük, and Kurban Höyük have been excavated.¹⁸ Whereas Titriş was located some little distance from the ancient Euphrates channel, these other excavated sites were, almost without exception, situated less than a kilometer from its banks. (As a result, all of them, save Titriş itself, are now submerged beneath Lake Atatürk.)

6.1: Settlement Patterns in the Karababa Basin during the Early Bronze Age

It is not the excavated sites, however, but rather changes in regional settlement patterns observed in archaeological surveys that provides the best evidence for change

¹⁸ The approximate locations of these sites are shown in Figure 6-1.

in the Karababa Basin during the Early Bronze Age. The two most pertinent surveys are those conducted by Wilkinson in the vicinities of Kurban Höyük (cf. 1990) and Titriş Höyük (cf. Algaze *et al.*, 2001). Changes in settlement patterns in the Karababa Basin over the course of the Early Bronze Age provide some of the strongest evidence for the rapid development and decline of the urban polities that emerged in this area during the course of the 3rd millennium. These processes are largely derived from a combination of remote sensing data, archeological survey data, and the results of archaeological excavation.

6.1.1: The Early EBA. For the most part, settlements in the Karababa Basin that had been occupied during the preceding Late Chalcolithic period experienced a marked retraction in the Early EBA. For example, the total site area of Kurban Höyük declined from around 5.6 ha during the LC to roughly 3.4 ha in the Early EBA (Wilkinson 1990: 96). Within that area, the extent of the primary Early EBA settlement at Kurban (Kurban Period V) was roughly 1 ha – just 1/6th of the area of main settlement during the following Mid EBA Period – while the areas of main settlement at two nearby sites, Site 8 and Site 24, were only 0.5 ha each (*ibid*).

As was the case throughout northern Mesopotamia, settlements in the Karababa Basin at the dawn of the 3rd millennium BC were little more than a scattering of agricultural hamlets across the landscape. The earliest levels of Titriş Höyük date to this time, suggesting that the site was founded during this phase. Unfortunately, however, the paucity of Early EBA levels from Titriş make it difficult to say much else about the settlement during this period, save that it was simply one of

a number of small villages in the Karababa area during the first centuries of the third millennium (cf. Algaze and Matney 2011: 997).

6.1.2: The Mid-EBA. The expansion of urban settlements that is the signature of archaeological settlement patterns for the Middle EBA in Syria can also be observed in settlement pattern data for the Karababa Basin. Titiş Höyük, which had achieved its maximum size of 43 ha at roughly the same time as Tell Leilan and Tell es-Sweyhat (Wilkinson 1994: 488), dominated the region, and occupied the nucleus of a four-tier settlement hierarchy in the catchment area. Although Titiş was small in comparison with the centers of the Upper Khabur, it was still by far the largest settlement in the area – approximately four times the size of secondary centers,¹⁹ and eight times larger than tertiary ones (Algaze and Matney 2011: 998-9; cf. also Algaze *et al.*, 2001: fig. 24, top right). Beyond these tertiary centers, a 4-5 km ring of tiny villages and independent farmsteads formed the final tier of the nucleated settlement hierarchy of Titiş Höyük (Algaze and Matney 2011: 999; also Ökse 2011: 272).²⁰

While the Middle EBA hierarchy of settlement immediately surrounding Titiş Höyük is fairly well documented, it is unfortunate that Middle EBA levels of the city proper are by and large buried some distance beneath Late EBA structures, and are therefore not as well understood (Algaze and Matney 2011: 998). Having said this,

¹⁹ A possible exception was Samsat Höyük, which may have been as large as 20 ha (cf. Erarslan 2009: 269). The actual extent of EBA Samsat, however, is unclear (Wilkinson 1990: 101).

²⁰ An increase in the number of smaller settlements in its immediate hinterland (as compared to the number of settlements during the Early EBA) appears to have been concurrent with the urban expansion of Titiş Höyük (cf. Algaze et al 2001: Fig. 24).

there is still a fair amount of information about the organization of the Middle EBA occupation of the site. The overall plan of Titriş was apparently similar to that most other Upper Mesopotamian sites, consisting of a high mound that was surrounded by a lower town (although at Titriş the latter was subdivided on the basis of depth of deposition by the UCSD-Şanlıurfa Museum excavation team into a “Lower Town” and an “Outer Town.”)

The city proper was ringed by nine possibly extramural suburban areas to the north, south, and east (cf. Algaze *et al.*, 2001: Fig. 22). It is not clear whether these were simply residential extensions of the city, as the word “suburb” suggests, or if they were set aside for other purposes, or both. However, excavations at Suburb 1 have revealed the presence of a lithic workshop (which will be discussed in more detail below), thus indicating that specialized industrial activities did take place in at least some of these “suburban” areas.

Secondary Karababa centers also appear to have developed their own miniature nucleated settlement hierarchies during the Mid EBA. At Kurban Höyük, for instance, the aggregated urban settlement area increased during this period from 1.5 to 6 ha (Wilkinson 1990: 97). It is also likely that three of the larger secondary centers, Lidar Höyük, Kurban Höyük, and Samsat, appear to have gained some kind of ascendancy over the smaller settlements of Gritille Höyük, Şaşkan Büyüktepe, and Birecik, respectively, which were located on the opposite bank of the Euphrates, and thus provided relatively easy access across the river from their larger counterparts (*ibid*: 101). Wilkinson suggests that the latter three were probably subordinate

settlements, whose growth was linked to that of the dominant polities (*ibid*). Although we cannot be absolutely sure, it is likely that the purpose of these subordinate settlements was to establish and control cross-Euphrates transit and communications (*ibid*).

6.1.3: The Late EBA. In the Karababa Basin, the process of transformation that unfolded during the Late EBA can be conceived of as having occurred in two phases: a period of reorientation, followed by one of contraction/abandonment. A handful of small tertiary sites situated to the south of Titriş Höyük, which had been settled in the preceding Middle EBA period, were apparently abandoned in the Late EBA (Algaze *et al.*, 2001: 57). It also appears that an equal number of new rural settlements were instead founded to the north of the city (*ibid*), suggesting that the people who lived in these smallholdings had found it prudent to withdraw from the southern plains for some reason at the end of the Middle EBA, and had migrated (or possibly, had been forcibly resettled) to the north of the urban center.

The reasons for this south-to-north migration of the rural population remain unclear. One hypothesis is that the retreat of settlers from the southern Karababa hinterland may have resulted from a conflict between Titriş and Tatar Höyük, a smaller urban center located 12 km to the southwest (Algaze *et al.*, 2001: 57). Another possibility, which has not yet been explored, is that annual precipitation regimes of the southern hinterland of Titriş, which were likely situated in a more marginal rainfall zone than the northern Karababa, may have become too unstable to

reliably support sufficient agricultural production, and accordingly the rural populations settled in this area migrated northward.

In any event, in addition to the reorienting of its rural hinterland, the urban center of Tiritiş Höyük itself also appears to have undergone a complete spatial reorganization at the beginning of the Late EBA period. The suburbs surrounding Tiritiş were apparently abandoned at the close of the Middle EBA, and the overall size of the city was reduced by nearly 25%, from 43 ha to 33 ha (Algaze and Matney 2011: 999). At the same time, the layout of the city was entirely transformed, in what Algaze and Matney describe as “a massive and well-planned urban renewal program” (*ibid*), which included the construction of a 7 m wide fortification wall on the eastern end of the city that guarded the approach to the city from the plain beyond (cf. Algaze *et al.*, 2001: 33-34). The break between the Mid and Late EBA is very clearly visible in the site stratigraphy: Late EBA buildings in the Outer Town were built directly over the much larger foundations of earlier Mid EBA structures, and the walls of the Mid and Late EBA buildings generally don't share the same plan or alignment (Matney 2002: 25).

According to Algaze and Matney, citing the work of Pournelle, who extrapolated from existing exposures (cf. Pournelle in Algaze *et al.*, 2001), the scale of this urban renovation project is impressive: “the Late EBA urban renewal program at Tiritiş would have required the quarrying, dressing, and transport of about 46,000 m³, or 92,400 metric tons, of limestone”, which was quarried from nearby hills roughly a kilometer to the north of the site (Algaze and Matney: 1007).

The motivation for this huge building effort is unclear. Given that Titriş Höyük dominates a natural corridor that leads to the ford across the Euphrates at Lidar/Samsat – the primary artery of trade across the river in this region – it is likely that the wall helped the city's authorities regulate the movement of traders passing through Titriş en route to or from the central Anatolian highlands. And of course, the wall was also a formidable fortification, which may therefore indicate a desire on the part of the local rulers to protect the city from military threats. It has also been suggested that Titriş Höyük may have become affiliated in some way with the Akkadian Empire, perhaps even serving as an Akkadian outpost (cf. Wilkinson 1990: 99-100).

Be that as it may, the reorientation process did not, however, succeed in reversing the declining fortunes of Titriş Höyük. For reasons that are still unclear, the polity disintegrated during the final centuries of the Late EBA. One possible explanation is that the city was beset by conflict with Tatar Höyük (cf. Algaze and Matney 2011: 999) – a conflict that Titriş evidently lost. Whatever the reason, the city of Titriş was itself virtually deserted by the end of the millennium. The Lower and Outer Town were both completely abandoned, and only a small holdover settlement on the High Mound was left, which was approximately 3.3 ha in size (Erarslan 2009: 272).

One potential point in favor of the conflict explanation is that the end of the Late EBA at Titriş Höyük seems to have been accompanied by an increase in interpersonal violence. Specifically, excavations in the Outer Town of Titriş revealed

a grisly feature: in a walled-up room within a residential complex near the Eastern Wall, the disarticulated skeletons of some 19 individuals were found in a large free-standing plaster basin (cf. Matney *et al.*, 1999: 189-90). The disarticulated bones in this assemblage found were piled up in the basin, with the crania positioned around the basin's rim (Erdal 2010: 3). The arrangement of the remains indicates that these people were not simply dumped there in a random mass burial. On the contrary, the apparently deliberate placement of the skulls suggests that these skeletal remains were, for unknown some reason, deliberately deposited in this plaster receptacle.

Osteological analysis of the remains from the plaster basin (cf. Erdal 2010) has revealed several intriguing points about the individuals who were ultimately interred there. For one thing, there were individuals of both sexes and a wide range of ages in the plaster basin group. A demographic analysis of the remains revealed that the plaster basin burial contained 12 adult males, 3 adult females, and 4 sub-adults whose sex could not be determined (cf. Erdal 2010: Table 2).

But by far the most striking feature of this unusual mortuary assemblage, however, is the exceedingly high frequency of unhealed perimortem cranial injuries among the assemblage – 16 of the 19 individuals buried in the basin exhibited some form of unhealed cranial trauma, including 13 (81%) of the 16 adults (*ibid*: 7). Of the 26 total cranial injuries, most were found on the parietal (61.3%), temporal (6.7%), or occipital bones (8.7 %), suggesting that most of these individuals were struck from the side or behind by their attacker(s), rather than facing them as would be expected if the victims were engaged in combat with their assailants (*ibid*).

Additionally, all but one of these wounds “were oval, ellipsoidal (canoe shaped) or irregular shaped,” suggesting that these individuals were all wounded by weapons of similar size and shape (*ibid*). The ellipsoidal injuries are reported to have likely come from “trapezoidal metal battle-axes that are common in Bronze Age Near Eastern weaponry” (*ibid*: 13), whereas the oval wounds are likely the result of the victims being struck by arrows or daggers (*ibid*: 14). Because of the unique and apparently deliberate composition of the burial assemblage, and the distinct pattern of the fatal injuries, Erdal has concluded that the plaster basin burial is “thus far unique evidence for a massacre that took place at a time of increasing social intra- or inter-group stress in the later part of the third millennium that affected not only southeastern Turkey but was also felt across much of Anatolia and the rest of the ancient Near East as well” (2010: 18).²¹

One bone sample from one of the individuals interred in the plaster basin burial was radiocarbon dated with AMS ¹⁴C dating in this study (see Chapter 3). The 1- σ and 2- σ date ranges for this particular sample (#AA104974) were 2448-2210 BC and 2462-2203 BC, respectively. While this does provide some indication of when this ancient massacre actually took place, it is not possible to assign a more precise date because of the broad 1- σ and 2- σ ranges.

Titriş Höyük is not the only site that experienced a significant disruption during the final centuries of the EBA. Kurban Höyük, for instance, was temporarily

²¹ Interestingly, the pattern of increasing Late EBA violence in Anatolia is not unique to Titriş; osteological evidence of violent conflict during the final centuries of the 3rd millennium has been discovered as far north at the site of İkiztepe on the Black Sea coast (Erdal 2010: 18).

abandoned from approximately 2100 BC (i.e., at the end of Kurban Period IVB) until the Middle Bronze Age, at which point it was partially reoccupied again (Wilkinson 1990: 102). The settlement area of the reoccupied site was reduced considerably; at 1.2 ha, the post-contraction extent of Kurban Höyük was roughly the same as that of the Early EBA settlement (Wilkinson 1990: 102). The nucleated settlement pattern around Kurban, which had been established during the Mid EBA, also collapsed at approximately the same time; numerous small settlements sprung up around this time, often very near to the locations of sites that had been occupied during the Early EBA, but subsequently abandoned during the Mid EBA urban florescence of Kurban (*ibid*). The contraction of Kurban and its hinterland was by no means unusual; the larger secondary center of Samsat also experienced a dramatic reduction in size and population, as well (Erarslan 2009: 272).

From the evidence discussed above, it is clear that the contraction that took place in the Karababa Basin during the Late EBA shares many broad similarities with the Khabur or western Syria, including increased social and economic stress and a significant reduction in the overall population of the region. Several centers in this area, in particular, experienced significant depopulation and a reduction in overall size.²² However, settlement pattern data and other archaeological evidence also suggest that while the Karababa Basin did experience something akin to the dramatic transformations which overtook the rest of Upper Mesopotamia during the Late EBA period, polities in the Turkish Euphrates were disrupted to a lesser degree than

²² This process appears to have accelerated after the destruction of Ebla (cf. Ökse 2011: 275).

elsewhere. Indeed, Ökse notes that in the Turkish Euphrates Valley, “[o]nly some major sites like Titriş Höyük [were] abandoned” (2011: 275). Moreover, although the end of the 3rd millennium was a difficult time for many of the urban centers of the Karababa Basin, some centers recovered, at least partially, at the beginning of the 2nd millennium. Indeed, the early 2nd millennium appears to have been a time of re-urbanization for Lidar Höyük and Samsat Höyük. The construction of a “palatial building” at Samsat, and the erection of similarly monumental fortification walls at Lidar Höyük, suggest that at least some of the Karababa Basin had experienced a return to urbanism by Middle Bronze II (Erarslan 2009: 286). These were, however, the exception, and are likely only an exception because they anchored the aforementioned ford across the Euphrates at that location. For the most part, the Karababa Basin was heavily depopulated during the traumatic EB-MB transition at the end of the 3rd millennium BC, and the region’s international importance would not again reach a similar height to that attained during the Early Bronze Age for a long time to come.

6.2: Early Bronze Age Agricultural Practices in the Karababa Basin

As was the case throughout southeastern Anatolia in the Early Bronze Age, the farmers of the Karababa Basin practiced dry-farming, and were largely if not entirely dependent on precipitation as the main source of water for their fields. Dry farming was practicable because Titriş lies within a relatively plentiful rainfall gradient – mean annual precipitation levels at nearby Kurban Höyük are approximately 450 mm/year

today, and it is probable that ancient rainfall regimes provided as much or more moisture (Wilkinson 2000: 9). The Karababa area was also fed by some of smaller tributary streams of the Euphrates in antiquity (although today a number of them, such as the Titriş Çay, are dry); however, as I have already noted, these are unlikely to have provided enough water to make large-scale irrigation agriculture feasible in the event of drought. As a result, the people of Titriş and other urban settlements in this area were far more dependent upon a stable and favorable climate than at downriver sites, such as Carchemish, where the river is less entrenched and it was possible to tap it with ancient passive irrigation technologies, and thus it was possible to mitigate the potentially devastating effects of prolonged drought by tapping into the Euphrates for an additional and relatively stable water supply. It is partly for this reason that climate change may have played a role in the political disintegration of Titriş Höyük.

Archaeobotanical finds from Titriş Höyük have made possible a tentative reconstruction of agricultural practices at the site throughout the Early Bronze Age. Among the charred plant remains excavated from the Mid and Late EBA levels in the Outer Town of Titriş, the most numerous specimens have been identified as two-row hulled barley, emmer wheat, legumes (especially bitter vetch and grass pea), and grape, with pistachio, acorn, and hawthorn also in evidence (Hald 2010: 71). The persistent presence of significant quantities of emmer wheat throughout the Early Bronze Age occupation of the city is intriguing and potentially significant, as this cereal does not tolerate drought well. Thus, finds of emmer in Late EBA levels could

potentially suggest that Titriş Höyük was not substantially impacted by drought, at least until it was largely abandoned.

While cereal crop cultivation was clearly central to the Titriş subsistence economy, circumstantial evidence from the site also hints at the continuation of foraging as a supplementary subsistence activity. In the Lower Town at Titriş Höyük, the clay layer filling the bottom of a plastered storage pit from Mid-to-Late EBA levels yielded hundreds of botanical impressions that indicate that the pit was used as storage for acorns (Algaze *et al.*, 1995: 24-5), which the residents of Titriş presumably gathered and processed either as a food for human consumption or as an animal feed.²³ Because the impressions are known only from a single pit, it is not possible to ascertain to what extent acorns were a part of human or animal diet at Titriş, but it is nevertheless clear that the peoples of the site were storing acorns in quantities sufficient to suggest that they were being deliberately collected, presumably as a food.

Apart from farming, the other primary wing of Titriş Höyük's subsistence economy was animal husbandry. To judge from zooarchaeological evidence, animal husbandry was key to both the growth and maintenance of the city. According to a recently published analysis of EBA Titriş Höyük faunal remains, of the 5444 remains which were identifiable to within at least a taxonomic family, 89% were of domestic animals, of which nearly all were identified as members of the *Bovidae* or *Caprinae*

²³ However, given that the acorns of some oak species that exist in the Eastern Mediterranean, notably *Quercus aegilops macrolepsis*, were also used in the processing and tanning of leather during antiquity (Sherratt 1999: 18), it is also conceivable that acorns could potentially have also been employed in a similar manner at Titriş.

family (Allentuck and Greenfield 2010: 14). This preponderance of domesticated ungulates in the faunal assemblage clearly shows that pastoralism, rather than hunting, was the principal means of exploiting animal resources at ancient Titiş.

The 2.4/1 ratio of ovicaprids to bovids in the Titiş faunal assemblage, moreover, indicates that the herding of sheep and goats, rather than cattle, was probably the most important pastoral pursuit (*ibid*). Among sheep and goats, the mortality frequencies for different age groups show a bimodal distribution, with peaks occurring either at 1-2 years or 6-8 years (*ibid*: 17; cf. also Allentuck and Greenfield 2010: Fig. 2.3). This finding suggests that a portion of the animals was culled for meat when they reached their peak adult weight, while the rest were purposed for secondary products that did not require the animals to be slaughtered, such as dairy or textile production.

It is not clear whether those animals not deliberately fattened for their meat were pastured in agricultural stubble fields, in pasturelands beyond the city and its immediate hinterland, or a combination of the two. There is now evidence to suggest that the Anatolian historical tradition of seasonal migration (see Section 4.2.2) was probably also employed at Titiş Höyük. Specifically, an interesting pattern can be observed in the results of a recent nitrogen stable isotope analysis conducted on archaeological samples of faunal tooth dentine from Titiş Höyük: samples of ovicaprid dentine of Early EBA date are enriched in the heavy nitrogen isotope species (^{15}N) in comparison with those of ovicaprid samples from later periods, and also those

of deer from all three EBA periods (cf. Trella 2010, *unpublished dissertation*). Trella (*ibid*: 313-314) interprets this pattern as follows:

It is clear from these results that whereas sheep/goat show substantial enrichment in ^{15}N for the Early-EBA, Deer do not. In fact, $\delta^{15}\text{N}$ is remarkably similar in the three deer bones analyzed, regardless of the period to which they date, which is what one would expect of wild herbivores living outside the agricultural catchment of the urban center and thus not feeding on a diet enriched with ^{15}N . Moreover, average values of $\delta^{15}\text{N}$ for the Mid- and Late-EBA sheep/goat bones closely resemble those obtained from deer of the same period. In fact, based upon these results, one could say that in terms of $\delta^{15}\text{N}$, sheep and goat bones from the Mid- and Late-EBA are utterly indistinguishable from those of deer; precisely what one would expect if they were eating similar diets, in similar environments. In other words, the results suggest that whereas Early-EBA sheep and goats spent substantial time in the agricultural catchment of the settlement, their counterparts from the Mid- and Late-EBA did not.

If Trella's interpretation is correct,²⁴ the nitrogen stable isotope evidence described above would thus be a strong indication that while ovicaprid flocks were pastured in the immediate vicinity of Titriş Höyük while it was a simple Early EBA village, they were not pastured in agricultural fields once the settlement began to expand during the Mid-EBA. Instead, these data suggest that the city's Mid- and Late-EBA ovicaprids were probably restricted to grazing in the upland pasture to the north of the city's immediate agricultural catchment. This point is of considerable significance, and I will return to it in my discussion of the results of the stable isotope analysis conducted in this study (see Chapter 10).

²⁴ Unfortunately, this explanation for the decreasing $\delta^{15}\text{N}$ values of ovicaprid, deer, and lagomorph bones cannot be properly assessed from the available evidence, due to the extremely small sample size for both deer and lagomorph bones ($n=1$ per period).

Finally, in addition to the information that it provides about the local animal economy and political structure of the city-state, the Titriş faunal collection is also interesting for what it lacks. Whereas pig remains were common in other Early Bronze Age sites in the Karababa Basin – they comprised 20-30% of the assemblage of Kurban Höyük during the EBA, (cf. Wattenmaker 1987: Table 2), and over 15% of the EBA assemblage from Gritille (cf. Stein 1987: Table 1), for example – only 12 pig bones have been identified from the EBA levels at Titriş Höyük (Allentuck and Greenfield 2010: 15).

It is not clear exactly why these animals are absent from the Titriş faunal collection. One possibility is that pigs, which are an excellent source of meat but provide no secondary products, and are primarily associated with small-scale, flexible subsistence strategies at the level of individual households (cf. Wattenmaker 1998: 159, 163-4), were simply not of sufficient economic value to justify a place in a specialized, centrally-controlled animal economy. Another is that environmental change may have been a factor, as “disappearance of woodlands, an ideal feeding ground for pigs, combined with an increase in cultivated area, may have made pig raising increasingly difficult” (*ibid*: 167). Indeed, it may be that both the prioritized agricultural pursuits of Titriş Höyük and the ensuing environmental damage which resulted from these activities (of which more below) are factors in the preclusion of pig remains from the faunal assemblage: pigs were not economically important enough to keep when environmental conditions were more suitable for them during the Middle EBA, and were subsequently ill-suited to the degraded environment in the

region after conditions began to worsen during the Late EBA. Or, it may simply be that the Euphrates banks provided a more suitable habitat for pigs than the Tigris corridor.

6.2.1: Evidence of anthropogenically-induced environmental degradation.

The pattern of human-caused environmental degradation throughout Upper Mesopotamia during the Early Bronze Age is also visible in the Karababa Basin. Indeed, the effects of anthropogenic activity appear to have resulted in significant environmental degradation by the end of the millennium. Wilkinson, for example, points to human activity as a major cause of erosion at Kurban Höyük as evidence that a gradual degradation of the landscape, dating to the Mid- to Late-EBA, “resulted from the accelerated erosion of nearby limestone slopes, [which] was in turn probably initiated by devegetation and forest removal” (Wilkinson 1990: 94). The same phenomena are also repeated around Tigris, as Pournelle has said (cf. Pournelle in Algaze *et al.*, 2001).

Diachronic change in faunal assemblage species distribution from Karababa sites such as Kurban and Tigris also provides a more indirect form of proxy data to corroborate the conclusions reached by Wilkinson. In particular, sudden decreases in the percentage of swine in faunal assemblages at sites not situated on the Euphrates – or in the case of Tigris, the almost total absence of pig bones in the faunal assemblage (as was discussed above) – may perhaps also be considered a rough indicator of land clearances or other ecologically destructive events such as floods, as pigs are comparatively ill-suited to the hot, dry, and sunny conditions that prevail on the open

jazirah, and therefore would have been difficult to keep in places which no longer provided sufficient forest cover.

In addition to the effects of agricultural expansion, the urban renewal effort at Titriş Höyük appears to have increased the detrimental impact of human activity upon the local environment. In particular, the massive, city-wide construction effort that was initiated at or just prior to the beginning of the Late EBA appears to have caused considerable damage to the landscape immediately surrounding the city. Pournelle estimates that the acquisition of timber for rebuilding the city within a single generation would have resulted in “a net loss of over 20,000m of wood from the forest cover surrounding the city per year of the Late EBA construction program” (in Algaze and Matney 2011: 1008), while a slightly more conservative figure places the total net loss of forest cover at 15-17 km², which is still considerable, especially in such a short space of time (Algaze *et al.*, 2001: 65). Regardless of the exact figure, it is probable that, as was the case at Kurban Höyük, this deforestation aggravated soil erosion and caused considerable degradation to the local landscape, especially given the high probability that the most heavily deforested areas in the vicinity of Titriş were probably those trees lining the banks of the Tavuk Çay which formed the southern boundary of the city (*ibid*: 63).

Further damage to the environment at Titriş was incurred as a result of intensive limestone extraction from the quarry north of the site. The extensive quarrying activity that took place during the city’s urban renewal transformed the Titriş Çay, a stream which had formed the northern boundary of the city’s suburbs

during the Middle EBA, “from a perennial source of water with an easily exploited floodplain into a deeply incised silted-up channel prone to episodic and destructive flooding” (Algaze and Matney 2011: 1007). Similarly, Pournelle considers the partial blockage of the Titriş Çay, and the increased risk of serious flooding which resulted from it, to have resulted from erosion “dramatized by quarrying, deforestation, plowing, and grazing” (cf. Pournelle in Algaze *et al.*, 2001: 59); however, she also notes that the failure of the stream to return to previous levels of discharge suggests that changing climates may also have been a factor in the decreasing flow rates (*ibid*). Whatever the cause, it seems that human activities associated with increasing populations and socioeconomic complexity may have indirectly played a key role in choking off the flow of water from the Titriş Çay, and consequently, in contributing to further damage to the landscape of the Karababa area as a result of flooding.

6.3: Archaeological Evidence for Increased Social and Economic Complexity in the Early Bronze Age Karababa Basin

6.3.1: Craft specialization in the Karababa Basin. As was the case throughout Upper Mesopotamia, the florescence of urbanism in the Karababa Basin also brought about a concurrent increase in economic specialization. The Mid EBA, in particular, witnessed the establishment of numerous full-time specialist craft professions. Of these, the production of sickle blades is one of the best understood industries at Titriş Höyük. The discovery of many exquisitely crafted Canaanite blades – not to mention over a thousand Canaanite blade cores – within a workshop

in Suburb 1 indicates that during the Middle EBA Titriş Höyük was employing full-time specialist craftspersons to mass produce these high-quality lithic tools (cf. Algaze *et al.*, 2001: 37-40). Both the dimensions and manufacturing techniques used to make these blades appear to have been highly standardized (*ibid*: 43-44). It is likely that the Canaanean blades were intended primarily for local use as sickle blades, and indeed, many were found in excavated houses within the site (cf. Matney *et al.*, 1999: 190-191). However, given the sheer quantity of these blades and blade cores, it seems unlikely that these were produced purely for local consumption; it is altogether more probable that a significant number were probably manufactured for export.

Interestingly, although the production of blades was highly specialized, Matney *et al.*, suspect that the workshop in Suburb 1 was “unlikely to have been controlled by elites at the site” (1999:193). Instead, they argue, the “modest” nature of the workshop and the fact that blades could be made from common materials without special equipment suggests that this was, despite the large number of blades being manufactured, a cottage industry (*ibid*). For my part, however, I see no reason why the unassuming character of the workshop would have exempted its products from state control, particularly in reference to that portion of the production intended for export. Rather, the standardization of the production method, the sheer quantity of blades produced in the workshop, and the fact that the blades were used as sickles (and thus connected with agricultural labor) makes it unlikely that their production would not have been overseen, at least to some extent, by the city authorities.

Several centers in the Karababa Basin also appear to have developed a local wine industry. There are two lines of evidence for winemaking at Tiriş Höyük: 1) the frequent occurrence of grape remains in the archaeobotanical assemblage (as discussed above); and 2) high concentrations of tartaric acid in the residue left in the bottom of a Late EBA plaster basin in one of the Outer Town households (cf. Matney *et al.*, 1997: 65). Outside of Tiriş, it is thought that winemaking was perhaps also practiced at Lidar Höyük and Kurban Höyük during the late 3rd millennium, if not before (Erarslan 2009: 285).

6.3.2: Social stratification and political complexity. In general, it is assumed that the urbanization of Tiriş Höyük also resulted in the development of a stratified society. Evidence for this social system is largely circumstantial, however, because the city has not yielded an archive of texts which might make it possible to piece together the details of the local social organization. Having said that, the presence of monumental architecture, the apparent existence of a bureaucratic civic administration, and archaeological evidence of the importation of foreign luxuries and other exotic goods – all of which will be discussed later in this chapter – do fit with the “typical” profile of a complex Early Bronze Age society in Upper Mesopotamia.

It should be noted, however, there is one feature of the local development of a hierarchical social structure at Tiriş Höyük that is very unusual for this region. In the extramural cemetery of unknown extent that dates exclusively to the Middle EBA period, which is located on a hill roughly 400 m northwest of the settlement, burials have yielded no real evidence of an unequal distribution of grave goods (Algaze *et al.*,

1995: 26). Looting of this burial ground by both ancient and modern tomb raiders has, unfortunately, complicated mortuary or osteological analyses of burials from this area, but to judge from the few examples of small finds excavated from those disturbed graves, which includes objects of bronze, silver, and shell, it is clear that at least some of the inhabitants of Titriş attained a greater degree of wealth during this time than in other periods (*ibid*: 27-28).

Intriguingly, despite the richness of the grave goods, a demographic analysis of the age and sex of individuals interred in this extramural cemetery was found to include a wide range of adults and children, and from this it has been hypothesized that “the cemetery was used by an entire community rather than by one social or professional class” (*ibid*: 28). If this interpretation of the admittedly small sample size of interments at the cemetery is correct, it follows that for some reason social stratification was not manifested in burial practices, which distinguishes Titriş from a majority of contemporary sites in the Syrian Euphrates, wherein according to Akkermans and Schwartz burials were typically differentiated by social status (cf. Akkermans and Schwartz 2003: 246-53). (However, it is unclear whether the known burials of Titriş are truly representative of the full variety of burial distinction.) Despite this anomalous burial practice, however, the majority of evidence does suggest that the social organization of Titriş was on the whole similar to that of other urban centers in Syria: hierarchical and centrally planned.

6.3.3: The political organization of Titriş Höyük. As I said earlier, we lack sufficient documentary evidence to say much about the political organization of Titriş

Höyük. But there are, however, a few telling indications that Titriş Höyük was indeed a centralized state with a fully-fledged administrative system responsible for managing the city's economy. For example, from the relative distribution of plant remains within the site of Titriş, Hald has inferred that agricultural production was centrally planned: "similarities in variety and relative proportions of crops found in the houses in the Outer Town [. . .] suggests that the crops found there could potentially have derived from the same source, rather than being the products of several individually organised, household-level, crop procurement strategies" (2010: 74-5). It is probable, then, that the charred plant remains found in the Outer Town were locally-grown, either in the city or in its immediate rural hinterland, and were then collected by city authorities and parceled out to residents in a redistributive system, as was the case throughout ancient Mesopotamia.

The total re-organization of the city during the Late EBA is another indication that Titriş Höyük was a state-level society. As Matney notes of the renovation in the Outer Town, the "regularity and symmetry of the [Late EBA] buildings, the presence of coherent subfloor drainage patterns and the degree of cooperation between neighboring building units [. . .] suggest that city planners laid out this section of the city according to well-established principles and with supra-household organization of space in mind" (2002: 26). The centralized nature of the Late EBA urban renewal of Titriş is also suggested by the linear, organized street system of the Late EBA Outer Town, which appears to have been deliberately laid out according to pre-arranged plans, rather than developing organically over time (*ibid*: 26-27). Additionally, the

massive fortification wall at the city's eastern boundary – a truly monumental construction that would have required the coordination and management of large pools of labor to build – also suggests that the effort to rebuild the city was directed by an institution that was able to oversee both the construction of the wall itself and to direct the acquisition of the large quantities of stone, timber, and other resources that were needed to build it.

While admittedly this evidence is circumstantial, the renovation of the city is nevertheless a strong indication that Titriş Höyük was both centralized and in possession of an administrative bureaucracy. Quite simply, it seems unlikely (not to say impossible) that the organization and execution of this major undertaking could have been successfully achieved without administrative oversight of the project. The sheer scale of the task would have almost certainly required carefully coordinated management, and the relatively uniform layout of the Late EBA Outer Town after it was finished suggests that the civic administration had both the managerial acumen and political clout needed to rebuild the city along lines that they apparently wished.

As is the case for the rest of Early Bronze Age northern Mesopotamia, whether the (semi-)nomadic groups who appear to have been at least partly responsible for the care of the city's pastoral resources occupied a position of any consequence within the stratified social structure of Early Bronze Age Titriş Höyük remains unclear. The ubiquity of sheep and goat remains in the Titriş faunal assemblage (see above) certainly does suggest that (semi-)nomadic pastoralists probably played some role in the economy of the city-state, and it is difficult to imagine that this was possible

without some kind of formal or informal understanding between city officials and the leaders of these pastoralist communities. Whether or not these relations were formalized in some way, perhaps along the lines of a dimorphic sociopolitical structure similar to that of early 2nd millennium Mari, is impossible to say on the basis of the currently available evidence. But it is certainly possible that the economic role of local pastoralist groups at least afforded their leaders some degree of social status, if not a place in the political elite of the city-state.

6.4: Evidence of Participation by Karababa Polities in Networks of Extraregional Interaction and Trade

Trade between the Lower Turkish Euphrates Valley and other peoples in the Tigris and Euphrates drainage basin has a long history; for example, the site of Hacinebi in the nearby Birecik-Carchemish Corridor was already involved in trade with cities in southern Mesopotamia during the Late Chalcolithic/Uruk period (cf. Schwartz and Hollander 2008). Prior to the 3rd millennium, however, long-distance exchange was primarily geared towards the export of raw materials, especially those that were valued by polities in the southern Mesopotamian alluvium after the advent of the Uruk expansion (cf. Algaze 1993). The development of new trading links during the Early Bronze Age, however, and the increased importance of peer-to-peer polity exchange of high-value, low-bulk luxuries and other commodities, probably helped to lay the foundations of the spectacular florescence of urbanism in the Karababa Basin, and the rise of Titriş Höyük to regional prominence.

Why, given its relatively small size, and the fact that the site was not located near a source of rare, high-value materials like tin or lapis lazuli, would Titriş Höyük have been an important player in long-distance trading networks? Algaze *et al.* argue that the location of the city, which guards the eastern approach to a key ford across the Euphrates at Samsat, was a key strategic advantage that considerably bolstered its economic position (cf. 1992: 33-34). Along these same lines, Şahoğlu has suggested that the site of Titriş can be considered the extreme southeastern limit of the Anatolian Trade Network (cf. 2005: Fig. 1). If this is correct, then the city would have served as an important juncture for overland trade between Central Anatolia and the Aegean Basin to the west, and the wealthy, sophisticated cities of Syria and Mesopotamia to the south and east.

6.4.1: Archaeological evidence of long-distance trade in the Karababa

Basin. It has been argued that long-distance trade was a key aspect of the political economy for the entire Karababa Basin, particularly during the Mid EBA and Late EBA (e.g., Algaze *et al.*, 1995: 39). The importance of trade was surely influenced by the strategic location of the Karababa Basin, which was an ideal hub for trade between the Anatolian interior and the plains of Mesopotamia (cf. Algaze *et al.*, 1992: 47). And, as I have already noted, it has been argued that Titriş Höyük was part of a trading system known as the Anatolian Trade Network, which stretched across the Anatolian Plateau and into the Aegean Basin (see Chapter 5).

Given its close proximity, the relative ease of transit, and the development of shared cultural traditions, it is not surprising that there are numerous lines of evidence

to suggest a substantial amount of interaction between the Karababa Basin and polities in northern Syria. The presence of Sugar-loaf beakers at Titriş, for example, demonstrates linkages with the Carchemish sector and the northern Tishrin Dam area (cf. Sconzo 2007: Fig. 17.7). There are also numerous examples of Syrian bottles, many of which were found in Late EBA burial contexts (Algaze and Matney 2011: 1004); this suggests that these bottles (or, more likely, their contents) were considered an important element of mortuary practice at Titriş during this period (cf. Laneri 2007: 259).

Evidence of trade between Titriş and southern Mesopotamia is more tenuous. One possible indication of interaction with the south is the recovery of several imported Early Dynastic III cylinder seals from partially-looted Mid EBA tombs, along with a poorly preserved ED III cylinder seal impression (Algaze *et al.*, 1992: 47). Apart from this, the only evidence of contacts with the south is circumstantial, and comes in the form of an Akkadian *mana* weight bearing the name of a late Akkadian king named Shu-Durul, which purportedly was looted from a tomb in the extramural Mid EBA cemetery at Titriş before eventually finding its way to the Şanlıurfa Museum (cf. Algaze 1990: 344-345).

The appearance of exotic luxury imports goods in cist tombs within the Mid-EBA extramural cemetery strongly suggest that in addition to its ties with the Mesopotamian world, Titriş was an active participant in long-distance, east-west trading networks that extended well beyond the Tigris-Euphrates Basin. The presence of three Karaz ware ceramic vessels found in a Mid EBA cache (cf. Algaze *et al.*,

1995: 39) indicates that the city traded with polities in Eastern Anatolia and the Caucasus. More strikingly still, the discovery of a handful of two-handled *depas* cups from Western Anatolia (cf. Algaze and Matney 2011: 1004), and also of numerous “violin-shaped” anthropomorphic marble figurines, which were almost certainly manufactured in Western Anatolia or the Cyclades (Algaze *et al.*, 2001: Fig. 35), provides evidence of linkages with the Aegean Basin to the west. The presence of the marble figurines is particularly interesting, because while they appear frequently in Mid EBA burials at Titriş, they are otherwise virtually unknown in southeastern Anatolia (Algaze *et al.*, 1995: 39). It is possible that Titriş somehow managed to monopolize access to these exotic items, or, perhaps, that the figurines were for some reason of no interest to other cities in the region (or that this may also be an accident of discovery). Whatever the reason, they are clear evidence that Titriş participated in a trading system, such as Şahoğlu’s Anatolian Trade Network, that connected the city with polities to the west as far away as the Aegean islands.

The ceramic assemblages of other Karababa sites indicate that Titriş Höyük was probably not the only Early Bronze Age settlement in the Basin to have participated in long-distance trade networks. For example, several ceramic sherds found in late 3rd millennium levels at Gritille Höyük bear a striking resemblance to wares from Syrian sites such as Tell Chuera, Tell es-Sweyaht, and Tell Leilan (cf. Voigt and Ellis 1981: 94-98). The links to Chuera and Leilan are of particular interest, as they suggest that at least some of the important trade routes going through the Karababa ran overland along an east-west axis across the *jazirah*, rather than traveling

exclusively up and down the Euphrates (*ibid*: 98). Similarly, a number of imported ceramics, including Karaz ware sherds, have also been found in Mid-Late EBA (Kurban Period IV) contexts at Kurban Höyük (cf. Algaze 1990: 333).

Seashells, though rare, were another exotic commodity imported by the elites of secondary Karababa centers. At Kurban Höyük, for example, two Indo-Pacific shells – one of which was a fragment of a *Nerita* shell, and the other that of a *Strombus* – were found in Late EBA contexts (Kurban IVB and III, respectively; cf. Algaze 1990: 415). These were apparently used as personal adornments; the *Nerita* was ground down and its apex pierced for use as an ornament (*ibid*). Both are believed to have originated from the Red Sea (*ibid*), and it is therefore probable that they were imported. That these exotic shells were considered valuable in northern Mesopotamia can be inferred from the fact that small numbers of them have been found elsewhere in Syria, including another example of a pierced *Nerita* shell found at Tell Hadidi, and five *Strombus* shells that were recovered from the Temple of Dagan at Mari (*ibid*).

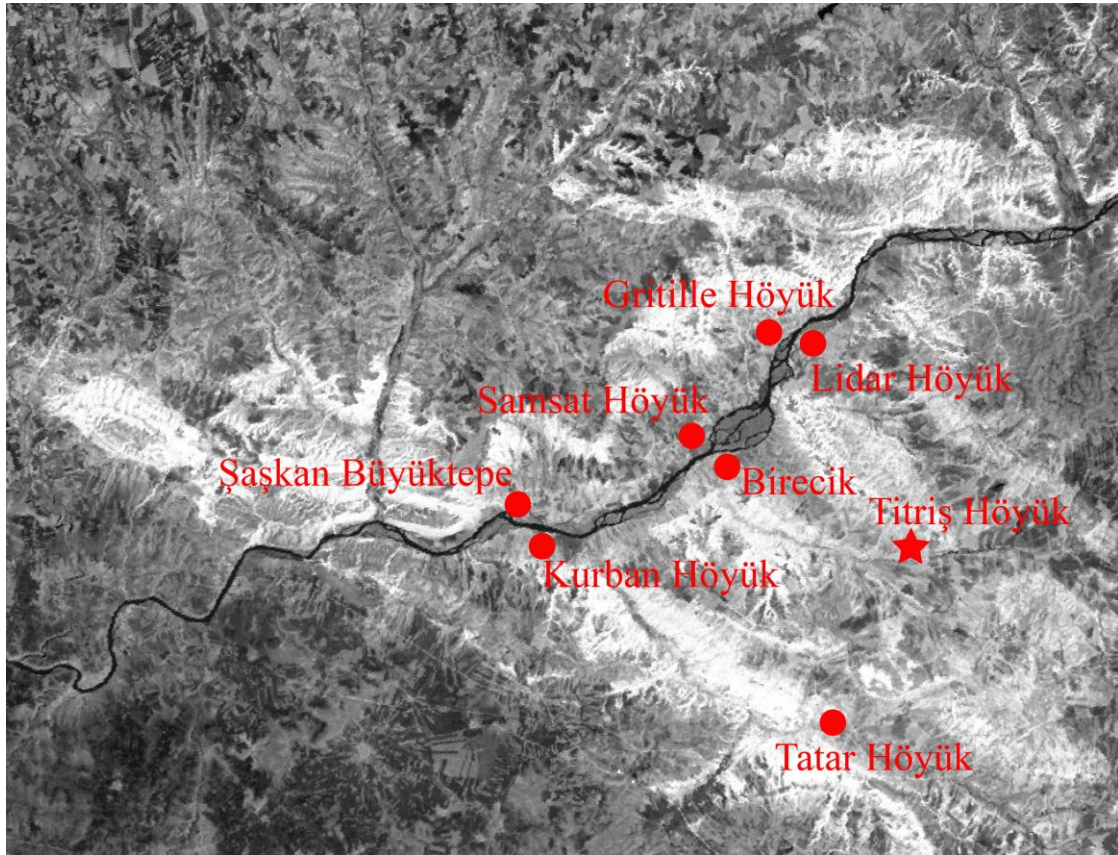


Figure 6-1: A LANDSAT photo of the Karababa Basin taken in 1983 (courtesy of NASA). The approximate locations of important EBA settlements in the Karababa Basin discussed in the text are shown as follows: Titriş Höyük is depicted with a star symbol; all other sites are shown as circles.

Chapter 7: Theoretical Principles of Stable Isotope Analysis

One of the most effective ways to ascertain whether the climate of the Lower Turkish Euphrates Valley did change during the late 3rd millennium BC – and, if it did, whether such a shift had any significant impacts upon the subsistence economy of Titriş Höyük – is through stable isotope analysis. Accordingly, an important component of this study is the stable isotope analysis of archaeological skeletal tissue samples from Titriş Höyük, Gritille Höyük, and Hacinebi. However, because the interpretation of isotope data requires an understanding of the theoretical principles and methodological constraints that are inherent to this technique, it is therefore necessary to pause here and briefly describe the theoretical principles that underpin this technique and guide the interpretation of stable isotope data. In particular, I will focus on those points that are pertinent to stable isotope research using carbon, nitrogen, and oxygen isotopes, and to the extraction of isotope data from mammalian osseous tissue.

7.1: General Principles of Stable Isotope Analysis

Isotopes are atoms of the same element which differ in atomic weights due to a variance in the number of neutrons within the nucleus. Because the number of protons in an atom for a given element is constant, regardless of the number of neutrons, isotopes are typically expressed with the sign YX , where X represents the atomic symbol for the element, and Y the atomic weight of the isotope (for example, an atom

of oxygen with eight protons and eight neutrons in its nucleus would be denoted as ^{16}O .) There are two types of isotopes: stable and unstable (i.e. radioactive) isotopes; a single element can have multiple stable and/or radioactive isotopes. The present work is specifically concerned with the analysis of stable isotopes (of which roughly 300 are known; cf. Hoefs 2007: 1). Of these, only 21 elements are “pure” elements - that is, elements which have only one stable isotope species; all other elements, including carbon and oxygen, have at least two (*ibid*). While different isotope species of a given element have the same electronic structure, the differences in atomic mass do have some effects on the physical properties of each isotope. For example, adding or subtracting a neutron from the nucleus of an atom can change the rate at which chemical reaction occurs or the temperature at which phase change occurs.

Isotope fractionation is a process that is of particular importance in the study of stable isotopes. Fractionation is “[t]he partitioning of isotopes between two substances or two phases of the same substance with different isotope ratios” (Hoefs 2007: 5). Isotope fractionation can occur as a result of many kinds of reactions, including “kinetic processes” (which are unidirectional, such as evaporation, diffusion, or photosynthesis), and “isotope exchange reactions” (which are sometimes also called “equilibrium isotope distributions”; *ibid*). Isotope exchange reactions are reactions where the distribution of isotope species within a single substance, or between multiple substances, is altered without changing the overall chemical composition of the substance or substances. In each reaction, isotope fractionation is also affected by

other factors, such as temperature, pressure, and the composition and/or molecular structure of compounds.

The presence and distribution of isotope species in a given substance is measured with mass spectrometers. In a mass spectrometer, a substance undergoes combustion into gas, and this gas is analyzed to assess the ratio of different isotope species found within the substance. Though mass spectrometry can be used to assess both the existence and frequency of isotope species in a sample, “[t]he accuracy with which *absolute* isotope abundances can be measured is substantially poorer than the precision with which *relative* differences in isotope abundances between two samples can be determined” (Hoefs 2007: 23). It is this relative difference in the abundance of stable isotopes which is the cornerstone of isotopic analysis.

Relative differences in isotope species distribution in a substance are reported as δ values between sample and standard. δ values express the ratio of rarer isotope species to more common ones in a substance (in parts per thousand, or ‰), as compared to the ratio of the same isotope species in a substance designated as an international standard. One of the international standards for oxygen isotopes, for example, is a carefully distilled water sample that is distributed by the IAEA called V-SMOW (Vienna-Standard Mean Ocean Water), while the other, which is also the international standard for carbon isotopes, is the Vienna PeeDee Belemnite (V-PDB). δ is defined as the result of the following equation: $[\delta = ((X_{\text{sample}}/X_{\text{standard}}) - 1) \times 1000]$, where X stands for the ratio of selected isotope species. As this study will focus on

carbon, nitrogen, and oxygen stable isotopes, X here would either represent the ratio $^{13}\text{C}:^{12}\text{C}$ for carbon isotopes, $^{15}\text{N}:^{14}\text{N}$ for nitrogen, or $^{18}\text{O}:^{16}\text{O}$ for oxygen isotopes.

7.2: Carbon Stable Isotopes

Carbon is one of the most common elements found in nature, and occurs in a wide variety of organic and inorganic compounds. Carbon has two stable isotopes: ^{12}C , the “natural” species, and ^{13}C , a heavier isotopic variant. The international standard for carbon isotopes, Vienna PeeDee Belemnite (V-PDB), is defined with the $\delta^{13}\text{C}$ value of 0‰. Most biological materials (and many inorganic ones) have $\delta^{13}\text{C}$ values that are negative, which is not an indication that ^{13}C is not present in a substance. Rather, the V-PDB standard is enriched in the ^{13}C isotope species in comparison to most other substances, including two biological compounds often analyzed as part of paleoecological reconstruction: collagen (a protein which is found in a variety of animal tissues, including bone and tooth dentin) and bioapatite (the inorganic biomineral portion of bone or tooth enamel.) These are denoted by the separate symbols $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{13}\text{C}_{(\text{apa})}$, and $\delta^{13}\text{C}_{(\text{en})}$, respectively.

Carbon stable isotope ratios in animal tissues can be used to reconstruct ancient climates because the isotopic composition of both plant and animal tissues is heavily influenced by the carbon cycle. The carbon cycle is a complex process involving the exchange of CO_2 between the ocean surface, atmosphere, and organisms that produce energy via photosynthesis (cf. Archer 2010: 2-9). As CO_2 is exchanged between these three reservoirs of carbon, isotope fractionation occurs as a result of

physical or chemical changes in the CO₂. For example, carbon isotope fractionation occurs during the evaporative transfer of dissolved CO₂ in the ocean, which on average has a $\delta^{13}\text{C}$ that is very close to 0‰, to the atmosphere, which leads to a relative ¹³C depletion of approximately 8‰ in $\delta^{13}\text{C}$ in atmospheric CO₂ (cf. Fry 2006: 45).

After being depleted while entering the atmosphere as CO₂, the heavier carbon isotopes in atmospheric CO₂ are depleted further during plant photosynthesis. Plants use one of several photosynthetic pathways to take in CO₂ from the atmosphere, each of which has different fractionation rates. The most common of these is known as the C₃ pathway, which is utilized by virtually all terrestrial plants in temperate environments, as well as all trees and many tropical shrubs. (Indeed, most plant species that are native to Upper Mesopotamia, including the wild variants of wheat and barley that were ultimately domesticated, are C₃ plants; cf. Bottema and Cappers 2000). In C₃ photosynthesis, atmospheric CO₂ is absorbed into the plant through the stomata, and then incorporated into the plant via the carboxylation of the enzyme ribulose biphosphate, more commonly known as “Rubisco” (O’Leary 1981: 554). Discrimination against heavier stable isotopes of carbon in C₃ plants occurs during the carboxylation process, which is reflected in a substantial depletion (approximately 20‰) in ¹³C (Fry 2006: 44). Not surprisingly, then, the worldwide average $\delta^{13}\text{C}$ value for C₃ plant tissues is reported as -28‰ (*ibid*) or -29‰ (O’Leary 1988: 329).²⁵

²⁵ It is important to note, however, that drought conditions can result in a relative ¹³C enrichment in C₃ plants, and therefore that $\delta^{13}\text{C}$ values for C₃ plant tissues can increase as much as 2-3‰ as a result of aridification (cf. Cerling et al., 2003: 459).

Two other types of photosynthesis are also known in terrestrial plants. The second most common type of photosynthesis is known as the C₄ photosynthetic pathway, which is typically utilized by tropical or semi-tropical grasses, as well as some sedges. Whereas C₃ photosynthesis involves the direct reaction of ingested CO₂ with Rubisco, in C₄ plants CO₂ is first taken up by carboxylation into a different enzyme known as phosphoenolpyruvate (PEP) in the mesophyll cells of the plant, before ultimately being converted into Rubisco (O'Leary 1988: 330). Because the initial carboxylation of CO₂ results in less discrimination against the heavy isotope than in C₃ plants, the worldwide average $\delta^{13}\text{C}$ value for C₄ plant matter is -14‰ (*ibid*).

Finally, an even less common kind of photosynthesis, called Crassulacean Acid Metabolism (CAM), is used by some desert succulents, such as cacti. CAM photosynthesis involves two different means of acquiring CO₂ from the atmosphere. At night, CAM plants open their stomata, and absorb CO₂ into PEP much like C₄ plants; during the day, however, many CAM plants then absorb CO₂ directly into Rubisco from the atmosphere, as C₃ plants do (O'Leary 1988: 331). As a result, worldwide average $\delta^{13}\text{C}$ values for CAM plants range between -10‰ and -20‰ (*ibid*).

In general, fractionation rates of carbon stable isotopes in plants that utilize C₃ and C₄ photosynthesis are significantly different from each other (while CAM plants can have $\delta^{13}\text{C}$ values that fall into either a C₃ or C₄ range). C₃ plants discriminate more against the heavier ¹³C isotope species than C₄ plants, and as a result C₃ plants have lower $\delta^{13}\text{C}$ values (O'Leary 1981). The mean $\delta^{13}\text{C}$ value for C₃ plants is $-28.1 \pm 2.5\text{‰}$; C₄ plants, on the other hand, have a mean $\delta^{13}\text{C}$ value of $-13.5 \pm 1.5\text{‰}$ (*ibid*: 554). It

should be noted, however, that aquatic C₃ plants exhibit values more typical of terrestrial C₄ specimens, which O'Leary attributes to a slower CO₂ diffusion underwater (*ibid*: 555).

Isotope fractionation of atmospheric CO₂ during photosynthesis is a process which has particular importance for interpreting carbon isotope data in animal tissues, as the ultimate source of dietary carbon in most ecosystems is plant matter. When animals ingest plant tissues (or animal tissues), further fractionation of carbon stable isotopes takes place as dietary carbon is metabolized during digestion, and becomes a component of various animal tissues. As a result, $\delta^{13}\text{C}$ values for samples of animal tissues reflect the ecological conditions in which an animal lives. Specifically, the isotopic distribution of carbon in animal tissues such as collagen or bioapatite can be used to infer the sources from which animals acquire energy and nutrients (cf. DeNiro and Epstein 1978).

Carbon isotope fractionation in animal tissues is a complex phenomenon, however, and a number of factors must be considered in order to correctly interpret $\delta^{13}\text{C}$ values. For example, different tissues fractionate dietary carbon at different rates, as do different components of some tissues. Moreover, animal species, physiology, and diet can also affect rates of fractionation to some degree. For example, in wild animals, the production of collagen causes carbon to fractionate at a rate of $\sim+4.5\%$ (Lee-Thorp et al., 1989: 587); whereas a recent meta-analysis of studies done with controlled feeding in a laboratory reported that animals fed controlled diets exhibited a diet-collagen fractionation rate of $\sim+3.6\%$ (Kellner and

Schoeninger 2007: 1121). Reported fractionation rates between $\delta^{13}\text{C}_{(\text{diet})}$ and $\delta^{13}\text{C}_{(\text{en})}$ are also variable, ranging from approximately +9‰ (Ambrose and Norr 1993) to $+14.1 \pm 0.5\text{‰}$ (Cerling and Harris 1999: 352). While diet and animal physiology almost certainly affect the diversity of reported diet-enamel fractionation rates, other factors, such as habitat effects, species-specific effects, and dissimilarity of experimental conditions may also play a role (*ibid*: 355).

Notwithstanding the variation in reported diet-collagen and diet-enamel fractionation rates, the differences between diet-collagen and diet-enamel offsets have been interpreted as evidence that $\delta^{13}\text{C}$ values from different tissues may correspond to different dietary signals. Collagen, for example, is often considered representative of dietary carbon acquired from protein sources, such as meat, fish or some plants. As a result, $\delta^{13}\text{C}_{(\text{coll})}$ is supposed to reflect the protein component of animal diet (Richards and Hedges 1999: 719), rather than the total diet, which is generally believed to be reflected by isotope distribution in the biomineral fraction of bone or enamel (cf. Ambrose and Norr 1993; Kellner and Schoeninger 2007). It should be noted, however, that only about ~60% of the carbon atoms in collagen are derived from protein sources; the other ~40% come from other dietary components (Froehle *et al.*, 2010: 2668). Thus, the protein source identification has an error of about +/-3‰ (Kellner and Schoeninger 2007).

7.2.1: Carbon stable isotopes as paleoclimate indicators. Carbon stable isotope analysis is frequently employed in reconstructions of paleoecological conditions, as ^{13}C ratios in plant or animal tissues can be used to infer a wide range of

details about past environments. For example, $\delta^{13}\text{C}$ values can be used to infer the degree of forest cover in areas which are heavily populated by C_3 plants, with lower $\delta^{13}\text{C}$ values indicating heavier forest cover and higher values suggesting a more open environment (cf. Hallin *et al.*, 2012: 61). Also, because $\delta^{13}\text{C}$ values in C_3 plants have an inverse relationship to mean annual precipitation worldwide (i.e., lower $\delta^{13}\text{C}$ values would indicate more rainfall, and vice versa), carbon stable isotope analysis can be used to infer precipitation levels in C_3 -dominated environments (Kohn 2010). In the Eastern Mediterranean, moreover, C_4 plants are only found in areas with an average annual rainfall of <350 mm/year, and therefore high $\delta^{13}\text{C}_{(\text{en})}$ values in mammalian herbivores reflect arid conditions regardless of whether the animal's diet was composed primarily of C_3 plants, C_4 plants, or a mixture of the two (Hallin *et al.*, 2012: 61).

Because of the plant ecology of the Upper Mesopotamian *jazirah*, the analysis of carbon stable isotopes in mammalian tooth enamel has the potential to serve as a valuable form of paleoclimate proxy data for conditions in the region during the Early Bronze Age. Throughout Upper Mesopotamia, C_3 plant species predominate today, despite the fact that the region is semi-arid (cf. Bottema and Cappers 2000: Appendix 1). To the best of my knowledge, no CAM plant species are native to modern Upper Mesopotamia. Very few native C_4 plant species are found in the area today, but $\delta^{13}\text{C}_{(\text{en})}$ values reported for Pleistocene goats at Qafzeh Cave, in what is now northern Israel, suggests that C_4 plant species were well represented in the Levantine coastal plains between 70,000-100,000 years ago (Hallin *et al.*, 2012: 70). It is therefore

possible that C₄ species were also present in Upper Mesopotamia during the Pleistocene, if not later.

Carbon isotope data can be used in the reconstruction of Early Bronze Age paleoclimate in several ways. For example, as the $\delta^{13}\text{C}_{(\text{en})}$ values for EBA ovicaprids will almost certainly reflect a diet consisting primarily of wild or domesticated C₃ plants, a statistically significant relative enrichment in ¹³C in animals from a particular occupation phase could potentially indicate the onset of increased aridity during that period, or also possibly the expansion of C₄ grasses into the region. Similarly, relative ¹³C enrichment in ovicaprid tooth enamel in a specific temporal phase could also betoken a significant loss of forest cover due to anthropogenic deforestation or other processes, particularly if oxygen isotope data from the same tissue samples do not indicate a reduction in mean annual precipitation. In summary, by obtaining $\delta^{13}\text{C}_{(\text{en})}$ values for analyzed ovicaprid enamel from Tiritiş Höyük, it becomes possible to explore not only what sorts of plants domesticated ovicaprids were grazing upon, but also whether the local ecology in the vicinity was impacted by changing climate, human impact, or both during the Late EBA occupation phase of the site.

7.3: Stable Isotopes of Nitrogen

There are two stable isotopes of nitrogen: the more abundant ¹⁴N, and the heavier ¹⁵N. Regardless of the isotope species, most of the nitrogen occurring in nature is found in the atmosphere, and as such atmospheric N², denoted as AIR

(Ambient Inhalable Reservoir) serves as the international standard. The $\delta^{15}\text{N}$ value for this international standard is defined as 0‰.

Organic nitrogen bound up in plants or other organisms is broken down by bacteria into other, more reactive compounds, such as ammonium or nitrate (Hoefs 2007: 49). So-called “nitrogen fixing” microorganisms actually take atmospheric nitrogen from the AIR. If the nitrate levels in soil are too low, the soil becomes less productive; isotopically, such a depletion of soil nitrate levels can be seen in an increase of $\delta^{15}\text{N}$ values in plants (Hoefs 2007: 50).

Plants typically have $\delta^{15}\text{N}$ values relatively close to ~3‰, and nitrogen fixing plants, such as legumes, tend to exhibit $\delta^{15}\text{N}$ levels closer to ~0‰ (Schwarcz and Schoeninger 1991: 304). However, other ecological factors can alter $\delta^{15}\text{N}$ levels in plants. As mentioned above, denitrification of soil can result in higher $\delta^{15}\text{N}$ values. Drier soils lose nitrogen more quickly, which also accelerates the increase of $\delta^{15}\text{N}$ values (Koch *et al.*, 2007: 112). Additionally, other factors, such as the proximity of a given plant to the ocean, can also alter its $\delta^{15}\text{N}$ values (*ibid*).

In animals, nitrogen occurs primarily in proteins.²⁶ Animal protein is typically enriched in nitrogen when compared to plants. Animals that consume terrestrial foods (average $\delta^{15}\text{N}$ value of $+5.9 \pm 2.3\text{‰}$; cf. Schoeninger *et al.*, 1983: Table 1) have lower $\delta^{15}\text{N}$ levels, on average, than those which consume mainly marine foods (average $\delta^{15}\text{N}$ value for aquatic mammals of $+15.6 \pm 2.2\text{‰}$; for sea birds $+12.9 \pm 2.9\text{‰}$; and for marine fish $+13.8 \pm 1.6\text{‰}$; cf. Schoeninger and DeNiro 1984: Table 2). It is because

²⁶ Thus, $\delta^{15}\text{N}$ values can only be from collagen in bone or dentin, as nitrogen is not a component of bioapatite.

the ocean is a longer trophic system that animal tissues of marine food consumers tend to be comparatively enriched in ^{15}N .

In either terrestrial or marine ecosystems, predators exhibit, on average, a +3‰ fractionation rate in $\delta^{15}\text{N}$ for each trophic level (Schoeninger and DeNiro 1984). Therefore, although the overall average for $\delta^{15}\text{N}$ in terrestrial animals is $+5.9 \pm 2.3\text{‰}$, terrestrial carnivores have a higher mean $\delta^{15}\text{N}$ value of $+8.0 \pm 1.6\text{‰}$ (*ibid*: Table 2). As may be expected, humans also exhibit this +3‰ enrichment when they acquire protein from foods, which is a significant reason why nitrogen stable isotope analysis is necessary for reconstructing human paleodiet. However, it must be said that other factors, such as starvation, pregnancy or lactation can also affect $\delta^{15}\text{N}$ values in some tissues of a given individual, and these must be considered during any interpretation of nitrogen stable isotope results.

7.3.1: Nitrogen isotopes as paleoclimate proxy indicators. For reasons outlined above, nitrogen stable isotope analysis is typically seen as a tool for investigating paleodiet or paleoecological reconstruction. However, nitrogen isotope ratios can also yield information about paleoclimatic conditions, as well. For this reason, I will pause here to briefly describe a handful of studies that have demonstrated how nitrogen isotope ratios can be linked to climate.

An illustrative example regarding the climatic influences upon $\delta^{15}\text{N}$ values is the result of a nitrogen isotope analysis of modern terrestrial herbivore bones obtained from several locations in southern Africa (Heaton *et al.*, 1986). In this study, a clear inverse relationship was detected between mean annual rainfall and $\delta^{15}\text{N}$. Elephant

bones provided some of the most dramatic evidence of this relationship (*ibid*: Fig. 2): while a group of some nine elephant bone samples obtained from South Africa's Kruger National Park (~600 mm/yr) exhibited $\delta^{15}\text{N}$ values around +5‰, the $\delta^{15}\text{N}$ values for three elephants from Damaraland in northwestern Namibia (~100mm/yr) ranged between +10.5‰ and +14.5‰ – $\delta^{15}\text{N}$ values that would typically reflect a diet rich in marine invertebrates!

One reason for this startling disparity in $\delta^{15}\text{N}$ values among animals with otherwise similar diets and physiologies is that climate appears to have some effect on ^{15}N concentrations in plants. Ambrose (1991: 297), for example, notes that isotope values for non- N^2 -fixing plants in xeric environments can be as high as +13‰, if not higher. Among N^2 fixers the increase is not as dramatic, but even so N^2 -fixing plants can exhibit $\delta^{15}\text{N}$ values of +6‰ or more in desert areas (*ibid*).

Animal physiology also affects the degree to which climate is reflected in nitrogen isotope ratios. For example, at a given level of mean annual rainfall, herbivores that are obligate drinkers tend to have lower $\delta^{15}\text{N}$ values than species that obtain water from other sources such as leaves (cf. Sealy *et al.*, 1987). Moreover, the effect of aridity upon the nitrogen isotope composition of body tissues is, to some extent, species dependent. For example, elephants in southern Africa tended to have lower $\delta^{15}\text{N}$ values in especially arid regions than other herbivores (cf. the discussion in Ambrose 1991: 299).

It should be readily apparent even from this limited discussion that the relationship between climate and the nitrogen isotope composition of animal tissues is

complex. For this reason, caution must be exercised when attempting to make inferences about climatic conditions with nitrogen stable isotope ratios. For this reason, nitrogen isotope analysis is not typically employed as a paleoclimate indicator by itself – when nitrogen isotopes are used to make inferences about climate, it is usually in conjunction with stable carbon or oxygen isotope data.

7.4: Stable Isotopes of Oxygen

Oxygen is the most abundant element on Earth, occurring in a wide variety of gaseous, liquid, and solid compounds (Hoefs 2007: 52). Oxygen is produced as a byproduct of photosynthesis, meaning that the global abundance of atmospheric oxygen is dependent on the abundance of plants in Earth's biosphere (Archer 2010: 7-8). Oxygen actually has three stable isotopes – ^{16}O , ^{17}O , and ^{18}O – but because ^{17}O is the rarest species, and has a smaller mass difference than ^{16}O and ^{18}O , most studies of oxygen isotope ratios prefer to compare ^{16}O to ^{18}O (Hoefs 2007: 53).

Whereas there is only one international standard for carbon, there are two for oxygen isotope ratios. Because it is the largest reservoir of water on Earth, and because its isotopic composition is relatively homogeneous, the ocean has been designated as a global standard for oxygen isotope ratios (except those in low-temperature carbonates, which use V-PDB as the standard; *ibid*: 55). The international standard for most oxygen isotope studies is known as V-SMOW (Vienna-Standard Mean Ocean Water), which is an artificial, carefully distilled water sample distributed by the IAEA (*ibid*: 25). As with the V-PDB standard for carbon isotopes, the $\delta^{18}\text{O}$

value of V-SMOW is 0‰. Despite its name, however, it should be noted that the oxygen isotope ratio of this international standard is not identical to the actual isotopic composition of ocean water, which exhibits slight spatial and temporal variations that are correlated with changes in salinity (Bowen *et al.*, 2007: 288). Finally, it should be noted that in archaeological oxygen isotope studies, $\delta^{18}\text{O}$ values are often reported relative to V-PDB. Accordingly, in Chapter 10 of this study I will present all $\delta^{18}\text{O}$ values as relative to the V-PDB standard, in order to facilitate easier comparison with other archaeological oxygen isotope studies that utilize this standard rather than V-SMOW.

Oxygen stable isotope analysis is used to establish the isotopic composition of water which falls as precipitation (meteoric water). Ratios of stable oxygen isotopes in meteoric water (denoted as $\delta^{18}\text{O}_{(\text{precip})}$) have a much greater range of variability than ocean water, largely as a result of the continuous depletion of ^{18}O in atmospheric water vapor that occurs as clouds cool while they travel over land masses (Dansgaard 1964). Thus, in places like low-lying coastal areas or tropical low-latitude regions which have relatively high atmospheric temperatures, ratios of oxygen isotopes are higher than at higher latitudes or altitudes, or in continental interior areas. However, the oxygen isotope composition of meteoric water is not simply governed by continentality, altitude, and temperature; “changes in vapor sources, atmospheric trajectories, and meteorologic dynamics can each affect the isotopic composition of rainwater in ways that are not directly related to simple measures of site temperature” (Bowen *et al.*, 2007: 288). It is necessary, therefore, to consider other factors, such as

wind currents or the presence of large freshwater lakes, when interpreting the climatic implications of oxygen isotopes ratios in meteoric water.

The isotopic composition of meteoric water is also affected by seasonality – i.e., the measure of the difference in $\delta^{18}\text{O}_{(\text{precip})}$ values between summer and winter (Fricke and O'Neill 1996: 97). In general, $\delta^{18}\text{O}_{(\text{precip})}$ values for winter precipitation for a given area are lower in winter than in summer (*ibid*: 96). Seasonal changes in ocean temperature and air-sea interactions are one of the primary factors responsible for this effect (Gat 1996: 244-5). The presence of snow in winter precipitation is another, as snow does not exchange isotopes with atmospheric moisture like liquid raindrops do (*ibid*: 256).

The effects of seasonality upon the isotopic composition of meteoric water can be quite substantial. In a 2005 IAEA report on seasonal variations in the isotope composition of precipitation over Turkey (Dirican *et al.*, 2005), samples of precipitation were collected daily for a period of 24 months (January 2001-February 2003) at 26 stations across Turkey, including three located in southeastern Anatolia at Adiyaman, Diyarbakır, and Şanlıurfa. The study reported that the range of $\delta^{18}\text{O}_{(\text{precip})}$ values for southeastern Anatolia measured between January 2001 and February 2003 ranged from approximately -3‰ in the summer to approximately -14‰ in the winter (*ibid*: Fig. 4). The pattern of seasonal disparity in $\delta^{18}\text{O}_{(\text{precip})}$ values demonstrated in southeastern Anatolia is typical of mid-latitude temperate regions, for the reasons described above.

In addition to demonstrating the degree of seasonality in precipitation regimes, the isotopic composition of meteoric water can also be used to map spatial variations in precipitation. For example, the results of the IAEA study of Turkish precipitation show a striking spatial disparity in mean $\delta^{18}\text{O}_{(\text{precip})}$ values within the southeastern Anatolian region: while the two-year mean $\delta^{18}\text{O}_{(\text{precip})}$ values for the station at Adıyaman (-8.53‰) and at Diyarbakır (-9.91‰) were similar to the average for all of Turkey (-8.40‰), the two-year mean $\delta^{18}\text{O}_{(\text{precip})}$ value for the Şanlıurfa station (-5.20‰) was considerably higher (cf. Dirican *et al.*, 2005: Table 1; Figure 3; Figure 4). As Şanlıurfa is located only 109 km to the southeast of Adıyaman, the relative enrichment of $^{18}\text{O}_{(\text{precip})}$ recorded at the Şanlıurfa station appears to indicate that the isotopic composition of precipitation is subject to substantial local variation in $\delta^{18}\text{O}_{(\text{precip})}$ in southeastern Anatolia, particularly on the leeward side of the Taurus Mountains.

7.4.1: Stable oxygen isotopes in mammalian tooth enamel as paleoclimate proxy indicators. Oxygen isotope analysis of the carbonate and phosphate components of mammalian tooth enamel has proved a successful means to infer details of past and present climatic conditions over the past two decades (e.g. Kohn *et al.*, 1996; Cerling and Harris 1999; Sharma *et al.*, 2004; Hallin *et al.*, 2012). Tooth enamel can be used as proxy evidence for past climates because the mineralization of enamel in mammals occurs at a constant body temperature, as oxygen isotope ratios in enamel tissue are linked to ratios in body water (Longinelli 1984). Specifically, oxygen isotopes are contained within both the phosphate and carbonate fractions of

hydroxyapatite, the mineral component of tooth enamel (Kohn *et al.*, 1996: 3889-90). Happily, the fractionation of oxygen isotopes during enamel mineralization in mammals varies only slightly in the phosphate and carbonate fractions of hydroxyapatite (1.02‰ and 1.03‰, respectively), meaning that the oxygen isotope composition of the phosphate and carbonate fractions of tooth enamel have both been shown to reflect the $\delta^{18}\text{O}$ values of body water during the process of tooth formation. Therefore, the analysis of oxygen isotopes within either compound can be used to investigate paleoclimates (Bryant *et al.*, 1996).

The carbonate fraction has become an increasingly popular choice in oxygen isotope studies (including this one), as analysis of the carbonate fraction in enamel allows for both $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values to be obtained simultaneously, whereas the phosphate fraction does not (*ibid*: 5145). Regardless of which fraction is chosen for analysis, however, the analysis of bulk $\delta^{18}\text{O}_{(\text{en})}$ values for whole teeth provides information about the isotopic composition of the groundwater which the animal ingested (provided that the animal is an obligate drinker) during the entire period of tooth formation (Fricke and O'Neill 1996: 98), which in turn reflects $\delta^{18}\text{O}$ values for meteoric water (Dansgaard 1964).

7.5: Diagenetic Contamination and Its Effects on Stable Isotope Ratios

Diagenesis is the term used to denote the chemical alteration of a given mineral substance. In archaeology, stable isotope analysis is primarily carried out on samples

of skeletal tissue, especially bone. As a result, this brief explanation of diagenesis will focus exclusively upon diagenetic processes that alter these tissues and their effects.

After deposition, bone can experience physicochemical alteration as a result of numerous processes. Prolonged contact with groundwater or soil water, for example, can cause ion exchange or other kinds of chemical transfer that can alter stable isotope values, and can also degrade the physical structure of bone (Wright and Schwarcz 1996: 934). Over time, bone collagen will also begin to break down, either as a result of microbial attack or temperature-driven physicochemical degradation (Hedges 2002: 322). Similarly, the crystalline structure of bone bioapatite can also become altered post-deposition, particularly after a substantial amount of bone collagen has been lost (*ibid*: 323). These physical changes to bone can increase its porosity, thus rendering it more vulnerable to diagenetic alteration from contact with water or other substances.

There are, fortunately, analytical techniques that can detect whether the isotopic composition of a given sample has been diagenetically altered. It is, for example, possible to infer diagenesis from the ratios of certain elements within the sample. Chemical diagenetic contamination can be inferred from carbon/nitrogen ratios (C:N) of collagen samples – if the C:N ratio is below 2.6 or above 3.4, this is usually a sign that the sample is diagenetically contaminated (cf. Schoeninger *et al.*, 1989).²⁷

Detecting diagenetic contamination in samples of bone bioapatite is typically done via Fourier-transform infrared spectrometry (FTIR), which provides information

²⁷ Collagen loss can also be detected via collagen yield – the amount of collagen (by weight) extracted from the original bone sample.

about both the crystallinity and the chemical composition of the skeletal tissue sample. Because the crystallinity – that is, the size and composition of apatite crystals – of bone bioapatite can be affected by diagenetic alteration is the crystalline structure of the bone resolubilizes post-deposition, FTIR can detect diagenesis by measuring the infrared splitting factor (IR-SF) of samples to test the degree of crystallinity in the sampled bioapatite (cf. Nielsen-Marsh and Hedges 2000b: 1152). FTIR can also be used to assess whether the carbonate content of bone bioapatite samples has been diagenetically contaminated through a comparison of the ratio of carbonate/phosphate (C/P) present in the sample (cf. Nielsen-Marsh and Hedges 2000a: 1142).

There are two different FTIR techniques. The standard method is to crush bone into a powder, which is then mixed with potassium bromide (KBr) into a pellet, and analyzed (cf. Hollund *et al.*, 2011: 508). A newer technique is attenuated total reflection FTIR (ATR-FTIR), which measures “the loss of intensity in a totally internally reflected infrared beam when it comes into contact with a sample” (*ibid*). The latter method carries several advantages over the former: samples do not require pre-treatment with potassium bromide, and avoids the potential for chemical alteration to occur during sample prep (*ibid*). ATR-FTIR was the technique employed in this study (see Chapter 10).

7.6: Impacts of Physiology, Diet, and Behavior on the Isotopic Composition of Ovicaprid Tooth Enamel

Finally, in closing this chapter, it is also necessary to say a few words about the

impacts of ovicaprid physiology and behavior upon the oxygen and carbon isotope composition of tooth enamel (which will be expressed henceforth as $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$). Because ovicaprid (and bovid) teeth feature frequently in carbon and oxygen isotope studies, the effects of their physiology, diet, and behavior upon the isotopic composition of tooth enamel are relatively well understood. For example, certain features of ovicaprid diet and physiology have important effects on the $\delta^{13}\text{C}_{(\text{en})}$ values of analyzed ovicaprid tooth enamel samples. Goats and sheep are opportunistic feeders, whose diets are highly dependent upon what foods are locally available (Loosli and McDowell 1985: 6-8). Loosli and McDowell note that in modern farming communities and villages, goats have been observed to consume “citrus husks and banana peels, corn husks, and other plant materials scattered along the roadways and paths, as well as the weeds, bushes, tree leaves and fallen leaves, and surplus grass” (*ibid*: 8). Given the potential for a significant variation in sources of plant food for these animals, the correct interpretation of $\delta^{13}\text{C}_{(\text{en})}$ values requires a detailed knowledge of local flora, especially the relative frequency of C_3 , C_4 , and CAM species in the area. Also, because $\delta^{13}\text{C}$ values in C_3 plants are affected by aridity, temporal changes in $\delta^{13}\text{C}_{(\text{en})}$ values may reflect either a change in animal diet or changes in local climate (or both!) Finally, as discussed above, there is some disagreement as to the fractionation rate between dietary $\delta^{13}\text{C}$ and $\delta^{13}\text{C}_{(\text{en})}$ in ovicaprids. Following Cerling and Harris (1999), this study will assume a diet-enamel fractionation rate of $+14.1 \pm 0.5\%$, which they convincingly demonstrate is typical for medium and large ruminants of the *Bovidae* family.

Physiological and behavioral traits – particularly those which impact the turnover of body water in a given animal’s body – also play a role in determining $\delta^{18}\text{O}_{(\text{en})}$ values in tooth enamel. Both sheep and goats are obligate drinkers, meaning that the ratios of oxygen isotopes extracted from ovicaprid enamel serve as indicators of the isotopic composition of local surface water, rather than humidity (cf. Kohn *et al.*, 1996: 3893; Hallin *et al.*, 2012: 63). Both species also exhibit a relatively high rate of turnover in body water: the biological half-life of water in sheep, for example, is only 5.4 ± 0.4 days, with most of the body water loss occurring as a result of sweating and respiration (Shirley 1985: 38). It was therefore in order to ensure that their sheep and goats received adequate hydration, especially during the summer months, that ancient pastoralists were forced to frequently relocate herds to seasonally available sources of freshwater. While archaeologists consider it unlikely that these pastoral migrations ventured many miles beyond the limits of urban centers (as previously discussed in Chapter 4), it is nevertheless possible that variation in $\delta^{18}\text{O}_{(\text{en})}$ could potentially be a reflection of spatial as well as seasonal disparities in $\delta^{18}\text{O}_{(\text{precip})}$ values.

Another important factor that must be accounted for when interpreting the results of stable isotope analysis of mammalian tooth enamel is the so-called “weaning effect”. Because 1) infant animals (including humans) receive much of their body water from suckling, and 2) the oxygen isotopic composition of milk is enriched in ^{18}O when compared to meteoric water, the $\delta^{18}\text{O}_{(\text{en})}$ values of teeth that are formed during the early infancy of a mammal will not accurately reflect $\delta^{18}\text{O}_{(\text{precip})}$ values (cf. Kohn

et al., 1998: 97). While some research into the weaning effect in humans has suggested that this ^{18}O enrichment can be accounted for by an offset of approximately $\pm 0.7\text{‰}$ in human teeth that form during weaning (e.g. Wright and Schwarcz 1998; Wright and Schwarcz 1999; White *et al.*, 2000), recent studies of oxygen isotope composition in the enamel of other mammals have continued to argue that, for most mammalian species, only oxygen isotope data extracted from post-weaning enamel tissue accurately reflects paleoenvironmental conditions (e.g. Sharma *et al.*, 2004: 22; Gehler *et al.*, 2012: 3). Accordingly, paleoclimate investigations which involve oxygen isotope analysis of mammalian enamel typically only analyze those teeth which are formed comparatively late in the lifespan of the animal (such as M^2 and M^3 molar teeth), in order to ensure that $\delta^{18}\text{O}_{(\text{en})}$ values are not skewed by the isotopic effects of a pre-weaning diet.

However, despite the limitations described above, and the fact that at present there are still only a handful of studies which have employed this technique in connection with the ancient Near East (e.g., van der Plicht *et al.*, 2012), stable isotope analysis of mammalian tissues assuredly has a bright future in Near Eastern archaeology. This is particularly true for investigations that seek to understand the changing climatic or ecological circumstances that encompassed ancient societies – including the present study – as ratios of stable oxygen isotopes in mammalian enamel can be used to reconstruct paleoclimates at very high temporal resolutions, while those of carbon isotopes can be employed to reconstruct ecological change. Thus, if samples are available from a series of continuous archaeological or geological strata,

the isotopic composition of mammalian enamel can serve as a record of long-term changes in local climates (Fricke and O'Neill 1996: 98), in a manner similar to that of cave speleothems.

Chapter 8: 3rd Millennium Paleoclimate Proxy Information from the Near East

Given that this study seeks to understand the human-environmental relationship that unfolded in the Karababa Basin during the course of the 3rd millennium BC, it is necessary to examine in some detail the available paleoclimate proxy evidence that forms the basis of our current understanding of its ancient climatic conditions. Unfortunately, however, there is precious little in terms of reliable proxy information about ancient climates in the Karababa Basin itself – it is partly for this reason that the stable isotope analysis of skeletal materials which will be discussed in Chapter 10 was undertaken as a part of this research.

Although very little can currently be said about the 3rd millennium climate history of the Karababa Basin itself, there is a fairly substantial body of available evidence for conditions during this period in other parts of the Near East. Thus, in this chapter, I will instead focus attention upon proxy records from several regions within the Near East, including northern Mesopotamia; the Levant; central and eastern Anatolia; and western Iran.²⁸ While it is not advisable to “plug in” these proxies as representative of the Karababa (for reasons that will become apparent below), an understanding of the regional climatic context is nevertheless valuable, as this can aid in the interpretation of the stable isotope proxies which will be presented later in this dissertation.

²⁸ The geographical locations of proxy records discussed in this chapter can be seen in Figure 8-1.

8.1: Selection Criteria for Proxy Records

The various paleoclimate proxy records employed in this reconstruction of 3rd millennium climate trends were not chosen at random; rather, several criteria were considered during the process of selecting which proxy records would be included. These criteria can be lumped into three broad categories: geographical criteria; chronological criteria; and finally, preferences regarding the type of paleoclimate proxies that were employed in the original studies.

Because conditions can vary considerably from place to place, geographical location was given the highest priority in the selection process. Two global weather systems are assumed to have played a major role in shaping regional precipitation patterns in the Near East in the past, as they do today: the North Atlantic Oscillation (NAO) and the El Niño Southern Oscillation (ENSO). In order to highlight changes in 3rd millennium climate that may have been influenced by these climate processes, the geographical provenance of Old World paleoclimate proxy evidence was an important consideration when evaluating sources of paleoclimate information. Virtually all of the data included in this and the following chapter were taken from a transect of the temperate or subtropical zones of the Old World, which extends northward from the northern boundary of the Tropic of Cancer (roughly 23°N) to the mid-point of latitude in the Northern Hemisphere (45°N), unless otherwise indicated. The area within these latitudinal bounds includes most of southern Europe, North Africa (including Sudan and Ethiopia), and the Near East – places whose climate is directly influenced by the NAO, ENSO, or both.

While geographical provenance was given the highest priority, chronological considerations were also a very important factor in the selection process. First and foremost, for obvious reasons, wherever possible proxy records with a well-anchored chronology were preferred over those with a less certain chronometric basis. The “quality” of chronometric dates, in turn, was assessed by several metrics, including: 1) the number of dates upon which the chronology was based; 2) the mean error ranges (both 1-sigma and 2-sigma, where available) for these dates; and 3) the number and mean error ranges for dates specific to the 3rd millennium BC. Secondly, proxy data that provided information about climatic conditions at a relatively high temporal resolution, such as a decadal or even annual scale, were given priority over those with lower temporal resolutions, as the former allow not only for a more accurate record of changes over time, but also reveal shorter-term changes in climate that might not be visible at lower temporal resolutions. Moreover, those local paleoclimate sequences with high temporal resolutions are particularly valuable in synthesizing various records to reconstruct regional paleoclimate trends over the course of the 3rd millennium, as these proxies provide a much more meaningful temporal basis for comparisons with other records than ones which cannot be dated with such precision. Finally, proxy records that provide a continuous dataset of paleoclimate conditions for the entire 3rd millennium were given priority over those providing data for only a portion of it.

A final consideration in selecting data for this study, which was marginally less important than geographical or chronological provenance, was the nature of the

paleoclimate proxy evidence which was reported in each study. Wherever possible, studies which based local paleoenvironmental reconstructions upon multiple lines of evidence, rather than a single type of proxy data, were given preference during the selection process. These were not always available, however, particularly in geographical areas in which Holocene paleoclimate is relatively understudied, so some of the reconstructions of local conditions included in this synthesis rely on a single form of proxy evidence in their reconstruction of local paleoenvironmental conditions.

In these cases, preference was given to those records based on two specific types of climate proxy evidence: 1) the biogeochemical compositions of sediment layers from lakebed and marine sediment cores; and 2) the other stable oxygen and carbon isotope ratios. I have chosen to focus upon these particular lines of evidence wherever possible because they are both types of evidence that “can be unambiguously attributed to climatic forcing,” (Roberts *et al.*, 2011: 3). By contrast, other types of paleoenvironmental data, such as pollen records, can be more easily influenced by anthropogenic activities (*ibid*). When necessary, however, I have also incorporated these other, less unambiguous lines of proxy evidence into my review in order to help flesh out the 3rd millennium paleoclimate sequence for the region.

8.2: Paleoclimate Proxy Evidence for 3rd Millennium Conditions in Upper Mesopotamia

Before discussing the local paleoclimatic evidence, I will first mark two important caveats concerning the limitations of the local paleoenvironmental record

for northern Mesopotamia: 1) the paucity of available proxy evidence to reconstruct local paleoenvironments; and 2) the problematic interpretation of the proxy evidence which is available. Regarding the paucity of the local paleoenvironmental record, Ur has noted that a particularly significant limitation to reconstructing paleoenvironments in Upper Mesopotamia is “the rapidly changing nature of the modern landscape [which has] greatly affected the survival of premodern landscape elements” (2011: 837). Human intervention in the local landscape and ecology is not merely a modern phenomenon, either; Reculeau reports that “[s]tudies of plant and animal remains from the Bronze Age have shown that the degradation processes, which were accelerated in the last centuries, are actually part of a long-term trend undergone since the beginning of human settlement in the region” (2011: 21). In short, because the “natural” Holocene environments of Upper Mesopotamia have been subject to anthropogenic alteration for millennia, most of the sources of information which would typically be employed to reconstruct the region’s Holocene natural history have been subject to continuous attrition by a succession of cultural processes that have grown increasingly destructive over time. Thus, while the present climate and ecological features of Upper Mesopotamia are fairly well understood, the same cannot be said for those of antiquity. Some broad diachronic trends have been tentatively identified, but unfortunately, because of the paucity of available proxy evidence for ancient climates in the region, a precise reconstruction of local paleoclimatic conditions has thus far proved elusive, particularly at a regional scale.

In general, archaeologists and paleoclimatologists have attempted to deal with this problem in one of two ways. The first solution is to look to proxy data from sites in regions hundreds (sometimes thousands) of kilometers away, such as lakes in the central Anatolian highlands or the Zagros Mountains, or cave speleothem data from the southern Levant, and extrapolate local conditions in Upper Mesopotamia from these sources, despite their geographical distance to the region. The advantage of this approach is that many of these data can be placed within well-established chronological climatic contexts, and thus provide a fairly reliable diachronic picture of climate in those areas. A major drawback of this approach, however, is that the evidence depicts conditions at locations which, because of their geographical distance and other disparities, are at best only suggestive of local paleoclimates within Upper Mesopotamia. Efforts to “fill in the gaps” in the local paleoenvironmental sequence with proxy data from elsewhere in the Near East are complicated still further by the diversity of climatic conditions that exist in Upper Mesopotamia (cf. Riehl *et al.*, 2009: 155). Thus, those studies which rely primarily upon proxy evidence from distant locales are not only problematic because they do not necessarily reflect climatic conditions in Upper Mesopotamia, but are made doubly so because of the fact that conditions may vary considerably even within this area, meaning that data from one locus may not reflect conditions at other, nearby sites.

The second method typically employed by archaeologists, on the other hand, is to rely almost exclusively on archaeobotanical or other materials that have been collected from specific Upper Mesopotamian urban sites and their immediate

hinterlands in order to reconstruct local paleoclimates (Reculeau 2011: 30). Two lines of archaeobotanical research are conducted in connection with archaeological inquiries: macrobotanical and microbotanical evidence. Macrobotanical studies, such as the identification of wood types in ancient charcoal, provide information about human use of plant materials – for instance, the availability of lumber for fuel (or lack thereof), and therefore the relative abundance of trees in a given area (e.g., Wilkinson 1990: 94; Algaze *et al.*, 1995: 30; Deckers and Pessin 2010). Microbotanical studies, particularly pollen analysis, are especially useful for archaeologists, as they provide a more comprehensive record of plant species, including those that are not preserved in macrobotanical assemblages. Pollen data are therefore quite valuable for reconstructions of natural environment as well as the impacts of human activity upon the environment. One negative aspect of palynological proxy information, however, is that “the identification level of the pollen data seldom is detailed enough to indicate former ecological conditions and local anthropogenic exploitation of plant species” (Bottema and Cappers 2000: 37). Similarly, the poor preservation of pollen in most Upper Mesopotamian archaeological contexts has, until recently, seriously hampered efforts to understand the vegetation history of this important area (Deckers and Pessin 2010: 216).

It is important to note that efforts to uncover “pristine” paleoclimate information in the Near East via either archaeobotanical method are complicated by those activities of ancient peoples, such as clearing forests, which intentionally or inadvertently aided the spread of wild plant species that thrive in open environments at

the expense of others which are better suited to forested areas (cf. Bottema and Cappers 2000: 51). As a result, reconstructions of ancient environmental conditions must utilize archaeobotanical data with caution, even at a local level, as this line of evidence can – and inevitably does – reflect changes in environment that were brought about by anthropogenic causes as well as abrupt changes in climate. In order to identify the roles of human activity and natural processes in bringing about environmental change, therefore, it is necessary to consider archaeobotanical data in combination with other kinds of archaeological and paleoclimate proxy evidence, which provide a much clearer and more accurate picture of ancient environments than it is possible to achieve with archaeobotanical data alone.

Despite the many difficulties inherent in reconstructing the ancient paleoenvironments of Upper Mesopotamia, there is still a good deal that we do know about the conditions which were prevalent in the region before the beginning of the 3rd millennium BC, and also throughout the course of the millennium. For instance, it appears that most of Upper Mesopotamia was heavily forested for much the Middle Holocene, and that the regional climate was sufficiently wet to support a wide range of tree species. In the Karababa Basin alone, for instance, there is palynological evidence of many native tree species including pine, oak, pistachio, fig, olive, wild hawthorn, willow, tamarisk, and poplar, particularly during the Early and Middle EBA periods (Algaze *et al.*, 2001: 63). The diversity of tree species, as well as the greater degree of forest cover in Upper Mesopotamia during the Middle Holocene than by the end of the 3rd millennium, suggests that the region was wetter than it is now. It should also be

noted that the presence of these forests was in all likelihood critical to maintaining the ecological equilibrium of this area in antiquity, as trees helped to prevent soil erosion, provided a variety of game and other resources, and may even have had a moderating influence on local climate (Deckers and Pessin 2010: 216).

While the archaeobotanical record does seem to provide a fairly clear and consistent picture of regional climate during the majority of the Middle Holocene, this is not the case for conditions during the 3rd millennium BC. In fact, the conflicting nature of the archaeobotanical evidence from the important urban center of Tell Brak (ancient Nagar) in the Khabur Basin of northeastern Syria perfectly illustrates the limitations of these data as a proxy for 3rd millennium paleoclimate. For example, the persistent appearance of plant remains of durum wheat, which requires a fairly high amount of water, throughout all 3rd millennium occupation layers at Tell Brak suggests that precipitation levels remained favorable enough to support this cereal crop. On the other hand, however, the predominance of weed species that are normally associated with desert or savanna environments in late 3rd millennium levels, and the comparatively rare occurrence of seeds belonging to weeds which do better in wetter conditions, seems to indicate that desiccation may indeed have impacted the site during the late 3rd millennium (cf. Charles and Bogaard 2001: 325-26; also Table 40). Thus, the archaeobotanical record at Brak provides two pieces of contradictory evidence regarding climatic conditions in the area during the 3rd millennium, and consequently these data are therefore of little help in determining whether local conditions changed during the late 3rd millennium BC.

For all of the confusion described above, one recent study has shed considerable light upon climate change in Upper Mesopotamia during the late 3rd millennium BC. This paper (Çakırlar and Şeşen 2013) reports the results of stable isotope analysis of bivalve shells obtained from two different sites in the Upper Khabur drainage basin of northeastern Syria: Tell Leilan, which was abandoned during the Late EBA; and Tell Mozan (ancient Urkesh), which appears to have survived this period relatively unscathed. In order to understand whether there was a relationship between drought and the differing fates of Tell Leilan and Tell Mozan, Çakırlar and Şeşen analyzed stable isotope ratios of modern and archaeological samples of freshwater bivalve shells recovered from Early Bronze Age contexts at each site. The carbon and oxygen isotope data obtained from these clam samples were then employed as intermediary anthropobiogenic proxies to infer the seasonal rhythms of local pluvial regimes, which would in turn have been affected by drought. It should be noted that while shell samples from Mozan dated to both the Mid EBA (2500-2400 BC) and the Late EBA (2100-1900 BC), those from Leilan dated only from level IIb (2300-2200 BC), the period immediately prior to its abandonment (Çakırlar and Şeşen 2013: 90-91).

The results of the stable oxygen isotope analysis are striking. At Mozan, the vast majority of $\delta^{18}\text{O}$ values for archaeological bivalve shells of both the Mid and Late periods remain relatively constant and stable, and are similar to or slightly lower than those of modern bivalve shells from the area (cf. Çakırlar and Şeşen 2013: Figs. 2 & 3). This is interpreted by the authors as an indication that the Jaghjagh River, a local

tributary of the Khabur, was still flowing perennially near Mozan throughout the late 3rd and into the early 2nd millennium, which in turn suggests that the site was not greatly affected by drought. The $\delta^{18}\text{O}$ values for the bivalve shells from Leilan, on the other hand, tell a very different story. The oxygen isotope evidence indicates that the local hydroenvironment at Leilan was arid and unstable during the final century of its occupation, at least in comparison to Mozan (cf. *ibid*: Fig. 4). Accordingly, despite its very close proximity to Mozan, Çakırlar and Şeşen conclude that Leilan was much more susceptible to the impacts of increased aridity (*ibid*: 92).

The Upper Khabur bivalve isotope data is valuable on two levels. First, it provides further corroborating empirical evidence that at least some parts of the Upper Mesopotamian *jazirah* were impacted by drought at or shortly before c. 2200 BC. In this sense, then, these data do appear to lend some support the notion that climate change was a key factor in the collapse of many Syro-Mesopotamian polities during the late 3rd millennium BC. On the other hand, however, this same study also demonstrates the tremendous complexity of the regional 3rd millennium climate history of the north Mesopotamian plains, and the remarkable degree of local climatic variation that must be presumed to have existed in that region in antiquity, even at very short distances. In short, then, the Çakırlar and Şeşen study both supports and problematizes the 4.2 ka hypothesis, at least with respect to Leilan and Mozan.

8.3: 3rd Millennium Climate in the Levant

Given the relative paucity and the equivocal nature of the available proxy

evidence from Northern Mesopotamia proper, an examination of contemporary proxy records from other parts of the Fertile Crescent is instructive. While these data cannot be “plugged in” to serve as equivalents for local conditions in the Karababa Basin or any other part of the *jazirah*, they are valuable in that they provide additional context about the nature of regional 3rd millennium climate trends.

A particularly pertinent proxy comes from the Rumailiah River Valley in the vicinity of the Early Bronze Age site of Tell Tweini (ancient Gibala), which is located on the Jableh coastal plain some 30 km south of the modern Syrian port city of Latakia. This particular record consists of an 800 cm sediment core sequence of alluvial sediments from the Rumailiah River. The age-depth model for this sequence was established with 4 AMS ¹⁴C dates (cf. Kaniewski *et al.*, 2008: Table 1); the bottom of the sequence dates back to the late 3rd millennium, possibly as far as 2200 BC.

An analysis of pollen counts obtained from the Rumailiah sediment core suggests that conditions were unusually arid along the Mediterranean coast of northern Syria during the final two centuries of the 3rd millennium (Kaniewski *et al.*, 2008). This was indicated by a higher than average concentration of xerophytic and thorny scrub pollens in the palynological sequence obtained from the portion of the sediment cores associated with the late 3rd millennium (*ibid*: 13942), and also by the results of principal components analysis (PCA) of the sediment core soils from the same section (*ibid*; also Fig. 2).

Interestingly, while the paleoclimatic record for the end of the Early Bronze Age in this area is strongly suggestive of a temporary increase in aridity during this time, it seems that the local human responses to this shift in conditions were varied. As Kaniewski *et al.* note, while the site of Tell Sianu, some 6 km to the north of Tell Tweini, was apparently abandoned during the last two centuries of the millennium (*ibid*: 13942), Tell Tweini itself appears to have been continuously occupied from its foundations in the Middle EBA through the Iron Age (*ibid*; cf. also Bretschneider and Van Lerberghe 2008: 17-20). Thus, the local archaeological record appears to show that in the relatively small Jableh plain, societal responses to the abrupt climate change that was experienced during the late 3rd millennium were not uniform, and that the episode of aridification was evidently not so severe that living in agglomerated urban communities was rendered completely impossible.

Further to the south, there are several strong indications of late 3rd millennium aridification in the southern Levant. This trend is attested, for example, in carbon and oxygen isotope data extracted from a cave speleothem at Soreq Cave, Israel, which was analyzed by Bar-Matthews and Ayalon (2011) to reconstruct trends in Middle Holocene (which they define as c. 7000-4000 BP) paleorainfall for the Eastern Mediterranean. The age model for the Middle Holocene section of the speleothem was established with 25 U-Th dates (cf. *ibid*: Table 1).

The results of the stable carbon and oxygen isotope analysis indicate that after c. 4700 BP ($\delta^{13}\text{C}$: $\sim -12.7\text{‰}$; $\delta^{18}\text{O}$: $\sim -6.2\text{‰}$), the climate in the vicinity of Soreq cave gradually became more arid through the remainder of the millennium (*ibid*: 169).

Interestingly, while both the carbon and oxygen isotope ratios from the speleothems indicate that aridity reached its peak intensity at the end of the millennium, they are not entirely synchronized; the highest $\delta^{13}\text{C}$ value (approximately -9.7‰) was observed in lamina dating to approximately 4050 BP, whereas the highest $\delta^{18}\text{O}$ value (approximately -5.1‰) was observed at approximately 4200 BP (*ibid*: Fig. 3). The overall trend remains clear, however: a relatively humid early 3rd millennium, followed by increasingly arid conditions that became especially dry during the final two centuries of the millennium.

A 2006 reconstruction of Holocene lake levels in the Dead Sea (Migowski *et al.*, 2006) has also yielded evidence of late 3rd millennium aridity in the southern Levant. Because the levels of the lake were influenced by the degree of freshwater runoff from the catchment area of the Dead Sea basin, the composition of lake sediment cores can be used as a proxy to indicate the degree of freshwater present in the lake over time, which is an important factor in determining not only the hydrochemistry of the Dead Sea in the past, but also serves as a proxy indicator for ancient rainfall regimes (cf. Migowski *et al.*, 2006: 422-4). Three cores were employed in this study (Ein Gedi, or DS-En; Ein Feshkha, or DS-F, and Ze'elim, or DS-Z); the age-depth models of each were established with 20 (DS-En), 6 (DS-F), and 12 (DS-Z) AMS ^{14}C dates, respectively.

An analysis of the lithological and mineralogical information from the three cores was used to reconstruct the lake level curve for the Dead Sea throughout the course of the Holocene. This curve revealed that there was a brief episode of

increasing aridity at some point during the late 3rd millennium BC (cf. *ibid*: Fig. 3). However, the authors also note that “the ~4.2 cal kyr BP arid event appears to be only a short excursion that lasted [approximately 300 years] in an otherwise wet period [of nearly a millennium] which continued until 3.5 cal kyr BP” (*ibid*: 426).

8.4: 3rd Millennium Climate in the Anatolian Plateau

The continental interior of Anatolia – that is, the Anatolian Plateau west of the Caucasus and north of the Taurus mountains – is unquestionably a part of the Near East, both geographically and culturally. However, this area is climatically distinct from the Fertile Crescent. Not only does virtually all of Anatolia north of the Taurus receive more annual precipitation than the lands to the south, but the precipitation regime of the former region is also less intensely seasonal than that of northern Mesopotamia (cf. Türkeş 1998).

Two proxies from this region have yielded compelling evidence of late 3rd millennium desiccation. The first of these is one of the most important sedimentary archives in the entire region – that of Lake Van, a large soda lake in eastern Anatolia (e.g., Wick *et al.*, 2003). The sediments of this lake are a highly valuable source of proxy information because Lake Van has yielded a continuous, finely laminated varve record dating back some 14,570 years (cf. Landmann *et al.*, 1996).

In the Lake Van sequence, two geochemical changes that are often associated with increased aridity can be observed in sediment levels dating to ca. 4200-ca. 4000 BP. The first of these is an increase in the ratio of magnesium to calcium (Mg/Ca) in

carbonates; the second an increase in oxygen isotope $\delta^{18}\text{O}$ levels in samples of autochthonous aragonite and calcite (cf. Wick *et al.*, 2003: Fig 4). Indeed, Wick *et al.*, interpret these changes as evidence of a shift started towards “a more continental climate” and “reduced humidity and lake levels” in the vicinity of Lake Van at this time (*ibid*: 673).

The other proxy record that provides evidence for late 3rd millennium climate, again indicating drought, is that of Tecer Lake, a small lake in the modern Turkish province of Sivas (Kuzucuoglu *et al.*, 2011). The age-depth model of this sequence is based on 11 AMS ^{14}C dates obtained from pollen grains that were extracted from the sediment core at regular 50 cm intervals (cf. Kuzucuoglu *et al.*, 2011: Table 2). In sedimentary layers from Tecer dated to approximately 2350 BC, Kuzucuoglu *et al.*, observed a “sudden rise in gypsum-rich sand input”, which was followed about a century or so later by a multi-century hiatus in the lake sediment sequence (*ibid*: 181). They interpret these changes in sediment composition as evidence of a 450-year long arid phase (*ibid*: 184). Because this sudden drop in lake levels took place at roughly the same time as at Lake Van, it appears from these data that both areas experienced a dry phase of similar duration during the late 3rd millennium.

8.5: 3rd Millennium Climate in Western Iran

Although a number of the proxy records cited here do seem to suggest that much of the Near East became more arid during the late 3rd millennium BC, it bears mentioning that proxy evidence from the eastern boundary of Mesopotamia indicates a

contrary trend in paleoenvironmental change. In stark contrast to other Near Eastern proxies, the Zagros Mountains of western Iran appear to have been subject to conditions that were more arid during the Middle Holocene than they are now, and became increasingly *wetter* during the course of the millennium. Whereas the 4.2 ka hypothesis, and indeed a substantial majority of the reported paleoclimatic and archaeological evidence from across the Near East, points to a period of intense desiccation during the late 3rd millennium, a 2006 stable oxygen isotope analysis of authigenic calcite within the sediment cores from Lake Mirabad and Lake Zeribar in the Iranian Zagros Mountains appears to contradict these data, and by extension, the premise of an ancient regional drought taking place during this period (Stevens *et al.*, 2006).

The oxygen isotope data from these two Zagros lakes suggests that if anything, the area became increasingly *wetter*, not drier, during the second half of the 3rd millennium. Stevens *et al.* report that “the interval of the Akkadian collapse (4200 to 3900 cal yr BP) is contemporaneous with a *decrease* in $\delta^{18}\text{O}$ values at both Mirabad and Zeribar,” which they attribute to “a return [from a spring rainy season] to winter-dominated precipitation” that is characteristic of a Mediterranean, rather than a continental climate (2006: 499, *emphasis added*). From the results of their research, they conclude that there is “no direct evidence for drought in the Zagros Mountains associated with the Akkadian collapse” (*ibid*). Stevens *et al.*, do acknowledge that “low $\delta^{18}\text{O}$ values [. . .] may indicate a return to Mediterranean-type conditions and subsequent early summers, low river recharge, and stronger *shamal* [northwesterly]

winds,” which may have had significant impacts on the discharge rates of the Tigris, and thus could have contributed to a hypothetical agricultural crisis in the Akkadian Empire (*ibid*).²⁹ In any event, assuming that the oxygen isotope data from Lake Mirabad and Zeribar represent accurately the conditions of the central and southern Zagros, it is evident that conditions there would have differed substantially from those of the rest of the Near East during the late 3rd millennium.

8.6: Regional Climate Trends in the Near East During the 3rd Millennium BC

Taken together, what do these proxy records tell us about the 3rd millennium climate history of the Near East? Well, for a start, a majority of these records (Tell Leilan, the Rumailiah River, Soreq Cave, the Dead Sea, Lake Van, and Tecer Lake) do appear to indicate that conditions became markedly drier during the late 3rd millennium. No change in local hydroclimatological conditions was observed at Tell Mozan, whereas in the Zagros lakes conditions appear to have actually become *less* arid over the course of the millennium. Finally, the Tell Brak archaeobotanical assemblage did not provide a clear indication either way

At first blush, the synthesis of these records appears to support the 4.2 ka hypothesis. However, although there is a certain amount of agreement between the majority of the proxy records cited here, this does not mean that the increased late 3rd millennium aridity that is recorded in these proxies should be attributed unilaterally to

²⁹ There is some evidence to suggest that drought may have helped to bring about a similar crisis for the Neo-Assyrian Empire in this same region during the mid-7th century BC (cf. Schneider and Adalı 2014)

a single climate event. Indeed, upon closer inspection, there are observable differences in the timing and amplitude of the late 3rd millennium arid phases indicated in these records. Moreover, while the arid phase in some proxy records is fairly prolonged, in others it was merely a short interruption within an otherwise humid period that lasted into the early 2nd millennium BC.

Why, then, is there so much variation evident within these proxies?

Admittedly, to some extent the discordance between these proxy records may be an artifact of chronometric dating issues such as relatively low temporal resolutions and high error ranges, which as a result make it difficult to precisely determine what conditions were at a given location over the course of the millennium. However, as the mean 1-sigma error ranges for the radiometric chronologies of these sources are generally a matter of decades rather than of centuries, I am disinclined to accept that this could by itself account for the full range of variation we see between the proxy sources.

In my view, the considerable variation that can be observed between our proxy records is better explained as evidence of the distinctly localized character of the larger climatic shift that appears to have gradually taken place during the latter half of the millennium. In other words, although a regional arid event has been recorded in numerous proxies, it appears that the various local manifestations of this event did not have identical chronologies or characteristics. The most dramatic example of this is surely the oxygen isotope ratios from the bivalve shell samples from Mozan and Leilan, which strongly suggest that the localized effects of climate change differed

significantly, even within the relatively small confines of the Upper Khabur Basin. Therefore, the main conclusion that should be drawn from the Near Eastern paleoclimate sequence is that it is dangerous to extrapolate proxy evidence for 3rd millennium conditions in one area of the Near East as applicable elsewhere. It is partly for this reason that an important aspect of this study is the establishment of new data to reconstruct the local 3rd millennium climate history of the Karababa Basin.

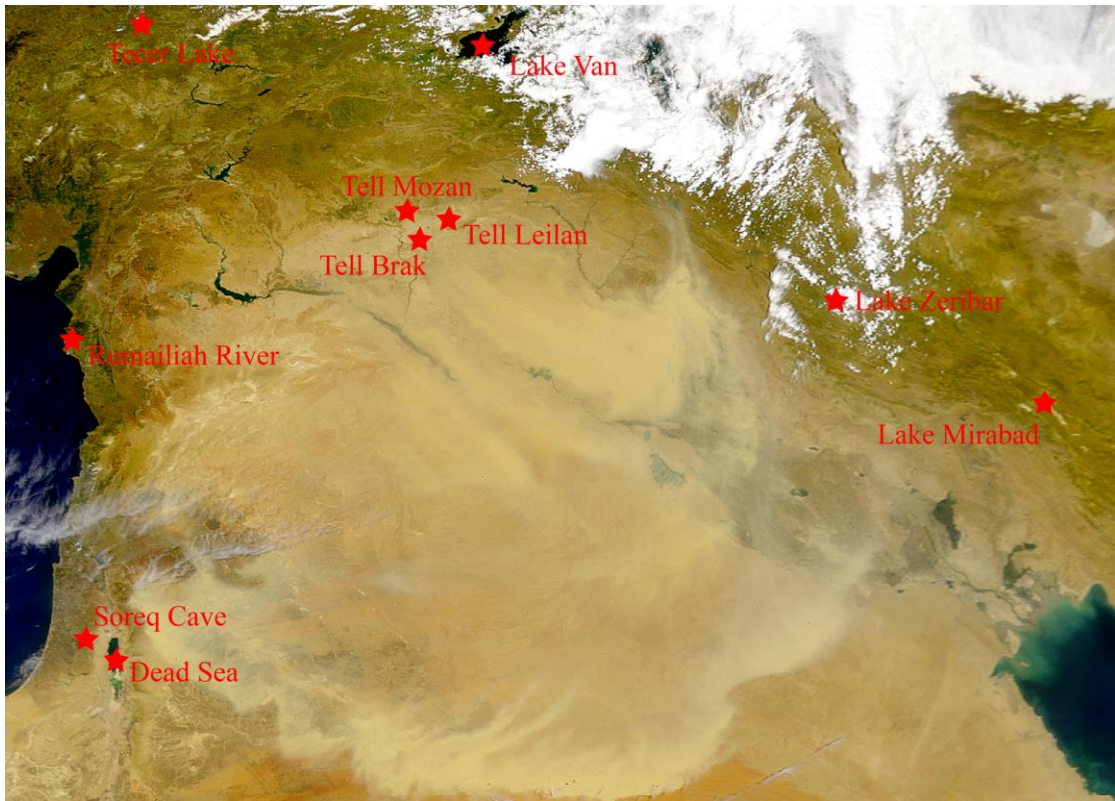


Figure 8-1: A map of the Near East (courtesy of NASA) showing the approximate location of proxy records discussed in the text.

Chapter 9: 3rd Millennium Climatic Conditions in the Eastern Mediterranean Basin

As noted in the previous chapter, the paucity of paleoclimate proxy records for the 3rd millennium BC in the Near East – especially within northern Mesopotamia – constitutes a major obstacle to understanding the local effects of the 4.2 ka BP event in this area. For this reason, in this chapter I will briefly review a series of proxies from other parts of the Eastern Mediterranean Basin and Northeast Africa³⁰ to probe further into the effects of this climatic event elsewhere. To reiterate a point I made earlier, it is not possible to simply fill in the gaps in the northern Mesopotamian paleoclimate sequence with proxy information from these other areas. However, they can provide much-needed additional context concerning the characteristics and complexities of the 4.2 ka BP event in the Mediterranean, and therefore help to aid in the interpretation of the isotopic paleoclimate proxy data that will be presented in Chapter 10.

This chapter focuses on proxy records from sources located in the Eastern Mediterranean Basin – i.e., Western Anatolia and the Aegean Basin, the Southeastern Balkans, the Red Sea Basin, and continental Northeast Africa as far south as Ethiopia (a map showing the locations of the proxy records can be viewed in Figure 9-1).

Given its proximity to the Fertile Crescent, and the fact that the same climate mechanisms are largely responsible for the climate of both areas, an understanding the

³⁰ The approximate geographical locations of proxy records from the Northeastern Mediterranean Basin and Northeast Africa are shown in Figure 9-1 and 9-2, respectively.

climatic history of this region is of particular importance in aiding the interpretation of the isotopic proxy information generated in the present study.

9.1: 3rd Millennium Climatic Conditions in the Northeastern Mediterranean

Basin

Beyond the Fertile Crescent proper, the Northeastern Mediterranean Basin – an area which is defined for the purposes of this review as consisting of highland Anatolia north of the Taurus mountains, the Aegean Basin (including western Anatolia and mainland Greece), the southeastern Balkan Peninsula, and the Adriatic Basin – is one of the most important sources of 3rd millennium climate proxy information available for reconstructing diachronic trends in regional climate that would also have impacted southeastern Anatolia. This is because the Northeastern Mediterranean area is affected by many of the same winter storm systems that provide most of the precipitation to the continental interior of southeastern Anatolia each year. Accordingly, changes in climate observed in this region can provide important details about large-scale climate trends that may also have influenced local conditions in the Karababa Basin.

Another reason that understanding late 3rd millennium climate in the Anatolian highlands and the Aegean Basin is important is that polities in these areas participated in the same regional trading networks as Titriş Höyük (which were already discussed in Chapters 5 and 6). Thus, if communities in these areas experienced serious economic or agricultural setbacks that were partly or entirely caused by climate

change, Titriş Höyük and other cities that participated in the long-distance exchange system could also have been indirectly impacted through the disruption of trade, even if they were not themselves facing local climatic instability at the same time.

9.1.1: Western Anatolia. Evidence for an episode of late 3rd millennium aridification in western Anatolia has been reported from Lake Gölhisar, a small, shallow lake in the Lycian Taurus Mountains of southwestern Anatolia (Eastwood *et al.*, 2007). Despite Lake Gölhisar's relatively low water level and diminutive size, the authors of this study were able to reconstruct a nearly 10,000 year paleoclimate sequence for the vicinity by analyzing ratios of stable oxygen isotopes extracted from calcites precipitating in the modern lake during summers over a multiyear period (1999-2003); these were then used as a baseline to assess relative levels of humidity recorded in calcites from earlier periods that were trapped within sediment core samples obtained from the lake (*ibid*: 330).

The oxygen isotope record from the Gölhisar sediments revealed “several sharp peaks of high isotope values” in calcites from sediment levels dating from c. 5200-c. 3700 BP (*ibid*: 336), including a multi-century peak of abnormally high $\delta^{18}\text{O}$ values in levels dating from c. 4500-c. 4000 BP (*ibid*: Fig. 6). A concurrent drop in the percentage of organic matter was also observed during this same period (*ibid*). Taken together, these data were interpreted by Eastwood *et al.*, as indications of a multi-century dry phase in the Lycian Taurus during the latter half of the millennium.

A sudden and brief drop in lake level associated with increased late 3rd millennium aridity has also recently been reported for Lake Iznik in northwestern

Anatolia (Ülgen *et al.*, 2012). The age-depth model of the lakebed sedimentary sequence from the core samples at Iznik is based on 9 plant and bulk organic carbon AMS ^{14}C dates (cf. Ülgen *et al.*, 2012: Table 3). Within this sequence, a brief arid episode, dating to c. 4400-c. 4200 cal. BP, was inferred from several changes in the sediment lithology, including an abrupt change in soil color, relatively high C/N ratios, and high Ca/Ti values (*ibid*: 94-95; also Figs. 5 and 6). Interestingly, however, the 3rd millennium paleoclimate sequence for northwestern Anatolia that was reconstructed from the Iznik proxy data indicates that the sudden dry spell appears to have been only a temporary interruption contained within an otherwise humid period lasting from 4720-3650 BP (*ibid*: 94-96).

9.1.2: The Aegean Basin. A recent study of marine sediments extracted from the Western Kos Basin of the extreme southeastern Aegean Sea (Triantaphyllou *et al.*, 2009) directly connects changes in the sedimentation sequence with the 4.2 ka event. The authors report an increase in sea surface temperatures (SST) c. 5400-4300 BP, and the contemporaneous appearance of a dark gray to olive gray mud with a high organic content, which they describe as “sapropel-like” (*ibid*: 194), along with “high numbers of the coccolithophore *Helicosphaera* spp.” which indicate a decrease in the salinity of the ocean (*ibid*). These proxy data all suggest that conditions were both warmer and more humid from 5400-4300 BP. Interestingly, this sapropel-like layer is not found in other cores from elsewhere in the Aegean – a fact which the authors suggest “could represent evidence of on-going, albeit weak, mid Holocene African monsoon forcing, only expressed in this sensitive locality at the southeastern edge of the Aegean Sea”

(*ibid*). Whatever the reason for the lack of a similar sapropel-like layer elsewhere in the Aegean, the “abrupt” termination of the layer of organic-rich mud c. 4300 BP is interpreted by Triantaphyllou *et al.* as evidence of a global cooling event, which “is expressed at low-latitudes as a mega-drought event that caused the collapse of Akkadian Empire in the Middle East by the displacement of the Mediterranean westerlies and the Indian monsoon” (*ibid*). Thus, for Triantaphyllou *et al.*, there is no doubt that conditions in the western Kos Basin are indicative of a sudden shift towards greater aridity c. 4300 BP, which they conclude agrees with the hypothesized mega-droughts that the 4.2 ka model puts down as the cause of the Akkadian collapse.

A very different picture of 3rd millennium climate has emerged, however, from the proxy evidence in the northern Aegean. A palynological analysis of marine sediment samples extracted from the Mt. Athos Basin, a trough in the northern Aegean Sea southeast of the Greek city of Thessaloniki, provides us with valuable proxy information about conditions in this area (Kotthoff *et al.*, 2008). The age model for the sediment core, SL152, is based on eight AMS ¹⁴C dates, which provide a very consistent age-depth curve for the core (cf. *ibid*: Fig. 2 & Table 1).

Kotthoff *et al.*, detected the presence of a short-term minima in non-saccate AP percentages in sediments from the Mt. Athos Basin dating to c. 4700-c. 4100 BP, and an increase in pollen percentage of heliophilous taxa, along with a concurrent lack of change in levels of Cichorioideae and Centaureacae pollen percentages, centered at c. 4300 BP (*ibid*: 1026). According to the authors, this indicates that “these changes in the composition of pollen assemblages represent drought events that affected the

vegetation in the Aegean Region” between c. 4700-c. 4100 BP (ibid). Interestingly – and in stark contrast to the late 3rd millennium mega-drought inferred from the Kos Basin marine sediment sequence – this dry phase appears to have begun well before 4200 BP, and to have terminated at a time when conditions in the Eastern Mediterranean were supposed to have been especially arid.

Further evidence for an earlier and more gradual onset of 3rd millennium aridification in the Aegean Sea area can be gleaned from the pollen record of Crete. According to Grove and Rackham, “[p]ollen evidence indicates a gradual change - the Aridization - over the Neolithic and Bronze Age; in Crete lime [i.e., linden] and hazel diminish over a long period, finally disappearing from the pollen record after 2500 BC” (Grove and Rackham 2001: 145). The localized extinction of these deciduous tree species on Crete during the mid-to-late 3rd millennium BC suggests that a gradual desiccation took place over a much longer period on Crete; by 2500 BC, this resulted in conditions which were unsuitable for species of deciduous trees that require a lot of water, such as hazel or linden, to survive on the island. As with the Mt. Athos Basin and Lake Gölhisar paleoclimate proxy data, the trend towards greater aridity attested in the Cretan pollen records occurred more than a century earlier than the date of 4300 BP indicated from the Kos Basin sediment core sequence. Moreover, according to Grove and Rackham, the shift towards the semi-arid Mediterranean climate of the island appears to have occurred gradually, not as the result of a single, punctuated event.

The gradual desiccation of Crete that was inferred by Grove and Rackham from the pollen sequence is, however, contradicted by the results of a recent study of Holocene flooding and river development in the Anapodaris Gorge of southern Crete (Macklin *et al.*, 2010). According to Macklin *et al.*, an intrusion of coarse sediments in the Holocene stratigraphy of the gorge dating to c. 4860-4200 BP actually suggests that the middle centuries of the 3rd millennium were a time of increased rainfall and more frequent, more intense flood events (*ibid*: 49-50). Incision in the lower Anapodaris catchment from 4200-3400 BP has been interpreted as evidence of “a period of significant cooling in the North Atlantic region [. . .] and southeast Aegean” (*ibid*: 49). The fact that this wet phase ended at 4200 BP is noteworthy, as this date suggests the arrival of cooler (and possibly drier) conditions in southern Crete was roughly contemporaneous with the onset of the “mega-drought” in the western Kos Basin reported by Triantaphyllou *et al.*

9.1.3: The Southeastern Balkan Peninsula. The geographical region denoted here as the Southeastern Balkan Peninsula is comprised of Albania, the Former Yugoslav Republic of Macedonia, and Bulgaria. Recent efforts to reconstruct paleoenvironmental conditions in the southern Balkans also provide further evidence for some kind of large-scale climate change event taking place during the 3rd millennium BC, but the findings of these studies also considerably complicate the picture of 3rd millennium climate trends in the northeastern Mediterranean as a whole. Conditions in this area appear to have a local climate history that is both locally distinct and highly complex.

In one recent study (Tonkov *et al.*, 2008), pollen counts from a 4200-year sediment core sequence at Straldzha mire in southeastern Bulgaria indicate that by the late 3rd millennium, stands of pine, oak, common hornbeam, maple, and hazel – which appear to have crowned the hills encircling the mire – were “already fragmented and destroyed to a large extent by the population of the local Bronze Age settlements [with] [s]econdary shrubby communities of *Carpinus orientalis* and *Juniperus* [having] developed in their place” (Tonkov *et al.*, 2008: 189). It is unfortunate that the pollen sequence from the Straldzha mire provides no data from earlier in the 3rd millennium, as such a record might help to determine whether a shift towards greater aridity in local climates played any role in the ecological shift that can be inferred from the composition of the pollen assemblage in the late 3rd millennium levels.

Having said that, although Tonkov *et al.* suggest that anthropogenic activity was responsible for this change in vegetation, another plausible scenario is that the expansion of juniper and other shrubby plants at the expense of species which prefer more moisture, such as maple and hazel, could also have been caused by a shift towards more arid conditions prior to 4200 BP. (Or, for that matter, it is also plausible that a combination of climate change-driven aridification *and* Bronze Age land clearances might together account for this shift.) Unfortunately, this must remain a matter of conjecture, at least for the present.

The lack of an earlier sequence at Straldzha is particularly unfortunate in light of the fact that a pollen-based proxy record from southwestern Bulgaria suggests that the onset of greater aridity took place in the Bulgarian highlands substantially *earlier*

than c. 4200 BP. This shift in local conditions can be observed in palynological data obtained from a peat bog in the Maleshevska Mountains of southwestern Bulgaria. The pollen record from the Maleshevska bog indicates a “sharp decline in the areas occupied by *Abies* [. . .] around 2760 cal. B.C. [which was] probably caused by a decrease in humidity (roughly corresponding to Bond event 4) and was reinforced by the intensification of human disturbance in all vegetation belts” (Marinova *et al.*, 2012: 420). Intriguingly, while the evidence from the Maleshevska bog does appear to indicate a trend towards drier conditions in the Bulgarian interior, this shift in local vegetation appears to have occurred some five centuries prior to the onset of the hypothesized 4.2 ka event.

The 3rd millennium climate history of the southern Balkans is also informed by a recently published sedimentary proxy archive obtained from the lakebed of Lake Ohrid on the Albanian-Macedonian border (Wagner *et al.*, 2009). Unlike the two Bulgarian paleoclimate proxy records discussed above, the published sedimentary archive from Lake Ohrid includes not only pollen counts, but also other paleoenvironmental data, such as sediment measurements and diatom analysis. The age-depth model for the lake’s 40,000 year core sequence was established with tephrochronology and AMS ¹⁴C dating of charcoal and plant remains (cf. *ibid*: 411-412). Sediments of late 3rd millennium date are part of a subdivision of the core known as Unit II.

The sedimentary sequence of Unit II has yielded two lines of proxy evidence to suggest a gradual increase in aridity in the vicinity that began during the late 3rd

millennium BC, and subsequently reached its peak c. cal. 3600 BP. The first of these is an increase in the total sulphur (TS) content of sediments in late 3rd millennium layers, which is interpreted by Wagner *et al.*, as most probably being a reflection of increased regional aridity (*ibid*: 424). Secondly, “a distinct decrease in carbonate concentration” at c. 4100 cal. BP and “a maximum in diatom abundance” is visible in layers dating to c. 4200 cal. BP suggests that the climate at this time became both cooler and drier in the vicinity of the lake (*ibid*).

In sum, it is difficult to know what to make of the paleoclimate sequences for the southern Balkans (not including the Greek mainland) during the 3rd millennium, and because the area is still relatively understudied its region-wide paleoclimate sequence remains something of an enigma at present. There are certainly some indications of a trend towards greater aridity during the third millennium, but the nature, timing, and causes of this climatic transition remain unclear. Whether the area was universally affected by drought c. 2700 BC, as suggested by the palynological evidence from Maleshevska, or c. 2200 BC, as suggested by the results of core sample analysis of Lake Ohrid, is uncertain; this issue will need to be resolved with future research.

9.1.4: The Adriatic Basin. There has been a renewed interest in the climate history of the Adriatic Basin during the past decade or so. As a result, there are a handful of recently published studies that shed new light upon our understanding of its climate trends during the 3rd millennium BC. I will discuss the implications of these studies for the larger picture of Eastern Mediterranean regional climate here.

The Dalmatian coast of modern Croatia has yielded several useful sources of proxy information concerning 3rd millennium climate in the Adriatic Basin. One example of this is the pollen record of sediments obtained from Malo Jezero, a coastal salt lagoon just off of the island of Mljet, which lies some 50 km to the west of the modern city of Dubrovnik. The forests of this island, which cover approximately 70% of its landmass, are today dominated by *Quercus ilex* (Colombaroli *et al.*, 2009: 316). Because this particular species thrives during periods of increased aridity (cf. Jahns and van den Bogaard 1998: 232), the relative abundance of *Q. ilex* pollen at various stages in the Malo Jezero sediment sequence therefore can be used to infer past humidity levels at Mljet. The chronology of the Malo Jezero sediment core (dubbed MJ3 by Colombaroli *et al.*) is based on an earlier ¹⁴C chronology of the same lake, which was anchored with five AMS dates from pollen concentrates (cf. Jahns 2002). The section of the sampled core that covers the 3rd millennium BC is known as MJ3-2b.

Several palynological indicators within MJ3-2b attest to an increase in aridity in the vicinity after 4500 BP. For instance, although the abundance of *Q. ilex* was comparatively minimal during the first half of the 3rd millennium BC, it steadily rose during the latter half, eventually reaching a peak during the early 2nd millennium (cf. Colombaroli *et al.*, 2009: Fig. 3a). During this same period, pollen levels of two other drought-tolerant plant species, *Juniperus* and *Artemisia* also increased – with the latter reaching an unprecedented level of abundance within the MJ3-2b record by approximately 4200 BP (*ibid*). These concurrent changes together suggest that a

climatic shift towards drier conditions was experienced on Mljet beginning in c. 4500 BP, with conditions becoming increasingly arid throughout the remainder of the millennium and into the early 2nd millennium, at which time peak aridity was reached.

A climatic shift towards greater aridity during the late 3rd millennium has also been observed in paleoclimatic proxy indicators from the northern Croatian Littoral. This change in conditions has been inferred from the sedimentary pollen record of Lake Vrana, a large karstic lake on the Croatian island of Cres. At Lake Vrana, a sudden expansion of *Quercus ilex* pollen occurred at a depth of 90 cm in the core section VRA96 (cf. Schmidt *et al.*, 2000: Fig. 3). Because the 80 cm depth of this sequence is AMS dated to 3518±80 BP (*ibid*: 126), the increase in *Q. ilex* is temporally correlated with the 4.2 ka BP event (*ibid*).³¹ The relative abundance of *Q. ilex* pollen in the Vrana sediment sequence in layers dating to the late 3rd-early 2nd millennium BC also suggests that the expansion may have been linked to a period of increased aridity. Whatever the cause, the *Q. ilex* expansion recorded in the Vrana sediments appears to have marked the end of a longer Mid-Holocene transition between deciduous oak forest and the development of the modern, Mediterranean-type vegetation that is now typical of this area (*ibid*: 127).

The results of an analysis of lakebed sediments at Polje Čepić, a lake situated in the southeastern portion of the mainland peninsula of Istria, has yielded further evidence of late 3rd millennium aridification in the northeastern Adriatic Basin. The sediment core from Polje Čepić was divided into three subsections: S1, S2, and S3 (in

³¹ Schmidt *et al.*, however, suggest that this palynological shift took place at least partly as a result of anthropogenic land clearances (2000: 126).

sequential order from oldest to youngest). Of interest here is the S3 core section, which has been dated to 4420-3870 cal. BP (Balbo *et al.*, 2006: 119) on the basis of an age-depth model anchored by four AMS ^{14}C dates (cf. *ibid*: Table 1 and Fig. 3), thus spanning the late 3rd and early 2nd millennia BC.³² This section is further subdivided into four subunits on the basis of sedimentary composition: L, OCS3, LCS2, and MCS2 (from oldest to youngest, respectively).

Within the S3 core, the absence of pollen grains and the presence of lignite in sediments from Unit L near the bottom of this sequence (i.e., during the late 3rd millennium BC) indicates that the lake was at a lowstand at approximately the same time as the *Q. ilex* expansion at Lake Vrana (cf. *ibid*: Fig. 7). From this it can be inferred that conditions in the vicinity of Polje Čepić were unusually arid during the late 3rd millennium BC. However, the presence of clay and clay-rich silt deposits in layers OCS3 (“organic-rich clay and silt) and LCS2 (laminated clayey silt) suggest that this dry phase was followed by a gradual transition towards increased humidity; by 3950 cal BP, if not slightly earlier, Polje Čepić appears to have entered a wet climatic phase (*ibid*). The nature of the changes observed in the sedimentary record of at Polje Čepić suggests that the dry period was followed here by a wetter phase.

Finally, evidence of late 3rd millennium aridification has also been found on the Western Adriatic coast of southeastern Italy. More specifically, a trend towards drier conditions during the latter half of the millennium can be observed in pollen

³² It should be noted, however, that there is only one AMS ^{14}C date for the S3 section itself. This date, which was obtained from bark, stem, and *Scirpus* seed samples near the top of the section (see Balbo *et al.*, 2006: Table 1), is reported as having a 2- σ range of 4074-3839 BP (median 3931 cal. BP).

records recovered from lacustrine sediments within the lakebed of Lago Alimini Piccolo, a small freshwater lake located in the Salento Peninsula. The age-depth model for the sedimentary sequence of Lago Alimini Piccolo was anchored with five AMS 14C determinants obtained from samples of organic sediment (cf. Di Rita and Magri 2009: Table 1).

The data extracted from the lacustrine sediment cores indicate a reduction in arboreal pollen and simultaneous increase in herbaceous pollen from sediment layers dating to the late 3rd and early 2nd millennium BC. This, in turn, indicates a period of drier conditions in southern Italy beginning in c. 4350 BP and ending c. 3900 BP, which appears to have caused widespread deforestation and a simultaneous expansion of shrubland environments (Di Rita and Magri 2009: 300-303). Di Rita and Magri argue that this sudden transformation of vegetation cover was not caused by anthropogenic activity, but instead occurred “mainly due to expansions of the anticyclonic belt” over the Azores and the Western Mediterranean (2009: 303) that resulted from “a general progression of a north African high-pressure cell towards the northeast affecting the Italian territory, but not the Balkan Peninsula, since around 4450 cal. BP” (ibid). If their surmise is correct – and it must be said, incidentally, that the evidence from the Balkans discussed in this dissertation seems to contradict the notion that only the Italian Peninsula was so affected – then it is also possible that the appearance of this anticyclonic belt was a key climatic factor in the onset of increasingly arid conditions in the Near East during the late third millennium, as the

redirection of Atlantic moisture into Central Europe by such a high pressure system would also have impacted precipitation levels throughout the Eastern Mediterranean.

9.2: 3rd Millennium Climate Trends in Northeast Africa and the Red Sea Basin

If the climate of the northeast Mediterranean Basin is largely similar to that of the Fertile Crescent, the same cannot be said of northeast Africa, the latter region's neighbor to the south. Northeast Africa has long served as a gateway of trade and travel between the Mediterranean world and that of the Indian Ocean (cf. Mitchell 2005), and its climate, which is influenced by the weather systems of both the Mediterranean Sea and the Indian Ocean, can also be thought of as something of a "melting pot". Thus, strictly speaking, most of northeastern Africa is neither a part of the Near East nor the Mediterranean Basin. However, this area is included in this chapter because it is very climatically sensitive, and local proxies in this subregion have yielded climatic signals that correspond with the 4.2 ka event. Moreover, because conditions in this area are heavily influenced by the El Niño Southern Oscillation – the climatic mechanism pointed to by Staubwasser and Weiss (2006) as the probable cause of the 4.2 ka event – a discussion of 3rd millennium climatic conditions in northeast Africa is salient to the present study.

3rd millennium climate change in northeastern Africa is attested in a reconstruction of Holocene lake levels at Lake Malha, a crater lake located in the northern Darfur region of western Sudan. The lake sediments extracted from Malha appear to indicate that the lake level was higher during the Middle Holocene than it

has ever been since, indicating a generally wetter climate (Mees *et al.*, 1991; Dumont and El Moghraby 1993). During the early 3rd millennium BC, the lake level began to decline sharply, eventually resulting in the total desiccation of the lake by c. 4500 cal. BP; the lake level then rose again through the late 3rd and early 2nd millennia before experiencing another sudden drying episode during the final centuries of the second millennium (cf. Mees *et al.*, 1991; also Dumont and El Moghraby 1993: Fig. 3). It therefore seems that the area around the Malha Crater was subjected to an intense drying episode during the early 3rd millennium BC.

Another proxy record from Northeast Africa that is pertinent here is the sedimentary archive of Tilo Lake, a crater lake located in the Rift Valley of southern Ethiopia. The chronology of the lakebed sediment sequence, which dates back to 8840 ± 50 ¹⁴C years BP, was established via 7 AMS ¹⁴C dates that were obtained from the analysis of samples of grass charcoal fragments (Lamb *et al.*, 2000: 170, also Table 4). The sediment sequence has been subdivided into three distinct units, of which one (Unit TL-2) covers the entire 3rd millennium BC.

The overall diachronic patterns of both the stable carbon and oxygen isotope ratios from Unit TL-2 are very similar. After remaining fairly stable through the first half of the 3rd millennium BC, $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values both drop sharply between c. 4400-c. 4350 BP, and then rise dramatically until ~4200 BP, by which time both reach a peak not attained for more than a millennium prior to that point (cf. Lamb *et al.*, 2000: Fig. 7). The TL-2 $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values remain unusually high for several centuries thereafter (although they exhibit some instability during this period),

eventually reaching their ultimate peak at approximately 3700 BP. Thereafter, both $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ drop precipitously over the next two centuries, indicating that the intensely dry phase at Tilo which began in approximately 4300 BP ended at or shortly after c. 3700 BP.

In addition to terrestrial Northeast African sedimentary proxy records, marine sediment archives from the northern Red Sea have also yielded evidence for a major climatic perturbation during the late 3rd millennium BC. Proxy information from the northern Red Sea is especially salient to this discussion for two reasons. The first of these is that because the Red Sea is restricted and surrounded by desert, it is very climatically sensitive (Arz *et al.*, 2006: 432). Secondly, as Arz *et al.*, explain, the deep water formation of the northern Red Sea is “strongly coupled to large-scale atmospheric processes in the Eastern Mediterranean region” (*ibid*: 436). Thus, sedimentary evidence of substantial changes in the deep water formation in the northern Red Sea can indirectly reflect changes in the climate of the eastern Mediterranean Basin.

Within the northern Red Sea lie a number of small-scale, brine-filled basins, including an area known as the Shaban Deep. The four sub-basins which make up this feature are largely anoxic today, but sedimentary records suggest that the relative oxygen content of the brine body in the basin has fluctuated several times in the past (*ibid*: 435). Because the Shaban Deep sediments are partially laminated, they are able to provide paleoclimatic proxy information at an unusually high temporal resolution. In order to assess the potential impact of the 4.2 ka event upon the climate of the

northern Red Sea, Arz *et al.* (2006) analyzed brine sediments from a core sample of the Shaban Deep. The section of core which they analyzed was radiocarbon dated to 5900-3900 cal. BP (*ibid*: 436). The age-depth model of this section was developed from six linearly-interpolated AMS ^{14}C dates with an average spacing of 300 years (cf. *ibid*: Table 1). The chronological precision of the Shaban Deep sedimentary sequence is attested by the fact that the AMS dates have a mean error range of ± 35.83 years, and none of the dates has an error range of more than ± 40 .

The Shaban Deep sediment archive has yielded several indications of a significant change in the local oceanography during the late 3rd millennium BC. In layers dated to before c. 4200 cal. BP, the sediments in the core were comprised of an alternating pattern of “light” laminae composed of coccoliths and terrigenous material, and “dark” laminae which are almost entirely composed of diatoms and organic matter (*ibid*: 436). These alternating light and dark laminae, which exhibited an average thickness of 120 μm , have been interpreted as a succession of annual summer and winter sediments (*ibid*). This laminated pattern suddenly ceased at c. 4200 cal. BP, at which time the sediments become more homogenous, total organic content (TOC) decreases, and endobenthic foraminifera (*Bulimina marginata*) slowly begin to appear (*ibid*). This change in the sediments has been interpreted as evidence of a reduction of the brine level in the Shaban Deep to below the depth of the core. Because unusually large high-pressure systems in the Mediterranean Basin – which, as Di Rita and Magri argue, may have played a role in bringing about the 4.2 ka BP event – cause northerly winds in the eastern part of the Mediterranean which bring in dry and cool air, thus

affecting the water column stratification of the northern Red Sea, the termination of laminated sediment deposition in the Shaban Deep is therefore likely connected to changing atmospheric conditions.

In addition to the sedimentary composition of the core section, stable oxygen isotope ratios were obtained from samples of surface-dwelling planktonic foraminifera (*Gobigerinoides ruber*) that were trapped within sediment layers (*ibid*: 435-436). During the early- and mid-3rd millennium BC, $\delta^{18}\text{O}$ values from samples of *G. ruber* ranged between -1.2‰ and -0.8‰ (cf. Arz *et al.*, 2006: Fig. 6). Beginning in approximately 4200 cal. BP, however, these values rose sharply towards a peak of +1.0‰ at c. 4100 cal. BP. They then suddenly retreated back to a more “typical” level (c. -1.0‰) by the end of the millennium (*ibid*).

Both the changes in the sedimentary composition of the Shaban Deep core and the oxygen isotope ratios of the *G. ruber* planktonic foraminifera within the core sediments appear to strongly indicate that deep water formation in the northern Red Sea was rapidly and profoundly affected by the onset of significantly drier conditions in the Mediterranean Basin. The timing of these developments is strongly correlated with that of the 4.2 ka event. Interestingly, the stable oxygen isotope proxy data from the Shaban Deep hint that this may have been a short-lived arid episode, lasting no more than perhaps 200 years.

9.3: Regional 3rd Millennium Climate Trends in the Eastern Mediterranean

Having briefly described each of the above proxy records, I will now employ them to develop a tentative reconstruction of regional paleoclimate trends for the 3rd millennium BC in the Eastern Mediterranean Basin. To begin with, it must be said that, as was the case in the Near East, there was a general trend towards drier conditions in the Eastern Mediterranean during the course of the millennium. However, this was not expressed uniformly in all proxy records, nor do these records appear to indicate that the onset of drier conditions took place simultaneously throughout the region.

In the Northeastern Mediterranean, virtually all proxy records indicate some kind of 3rd millennium desiccation event. This perturbation appears to have begun at some point between c. 4300-c. 4100 BP in the Western Kos Basin, the Anapodaris Gorge, Lake Ohrid, Malo Jezero, and Lake Vrana, which suggests that a substantial portion of this region was impacted by the 4.2 ka BP event. Having said that, however, proxy evidence from Lake Gölhisar, Lake Iznik, the Mt. Athos Basin, the Maleshevska bog, and Polje Čepić, all appear to indicate that aridification in these areas took place at least two centuries prior to 4200 BP – and, in the case of Lake Iznik and the Mt. Athos Basin, terminated either in c. 4200 or c. 4100 BP, respectively. In one record, Lago Alimini Piccolo, the onset of desiccation occurs at c. 4350 BP – just on the edge of the 4.2 ka BP event.

The addition of Northeast African proxy records does little to alleviate this confusion. On the one hand, both the Tilo Lake and Shaban Deep proxy records

appear to suggest that drier conditions began to set in between 4300-4200 BP. These records thus appear to agree well with the evidence for late 3rd millennium desiccation in the Northeastern Mediterranean that has just been described above, and also coincide with the timing of the 4.2 ka BP event. On the other, at Lake Malha in western Sudan, the desiccation of the lake took place during the early 3rd millennium, as was the case for the handful of records in Western Anatolia, Crete, and Bulgaria. At Lake Malha, however, conditions then became *more* humid once again during the latter half of the millennium – a trend that is not observed in any of the other proxies discussed in this chapter. It is likely that Malha is an outlier in this regard (perhaps due its location in the interior of western Sudan), but whatever the reason, this record clearly does not fit the profile for the 4.2 ka BP event.

Despite the contradictory nature of the Eastern Mediterranean proxy records, there are some general trends in 3rd millennium climate that can be observed at a regional level. Taken as a whole, the paleoclimate proxies from the Eastern Mediterranean Basin and Northeast Africa do indicate that across the region, conditions generally (though by no means universally) became more arid at some point during the millennium. It is possible that there were, in fact, two different dry phases – one at the beginning of the millennium, and the other at its end – each of which impacted at least part of the Eastern Mediterranean Basin. If we assume this to be the case, then the fact that a majority of the proxies have recorded evidence of late rather than early 3rd millennium desiccation suggests that the latter dry phase was probably more intense than the former one.

Even so, these records do not provide unequivocal evidence to suggest the presence of a single, dramatic climate event that caused widespread drought between c. 4200-3900 BP. On the contrary, these proxies appear to support the contention of Finné *et al.*, who argue that the majority of available proxy records from this period “do not indicate anything as well-constrained in time or as unique in amplitude as would be expected for an event-like drought” (2011: 3163). Rather, the most plausible interpretation of the available evidence is this: it is likely that there was a trend towards aridification in the Eastern Mediterranean Basin during the late (and possibly the early) 3rd millennium BC, but that this was subject to considerable localized variation in its timing, duration, and amplitude.



Figure 9-1: A map of the Northeastern Mediterranean (original satellite image courtesy of NASA) showing the approximate location of proxy records discussed in the text.

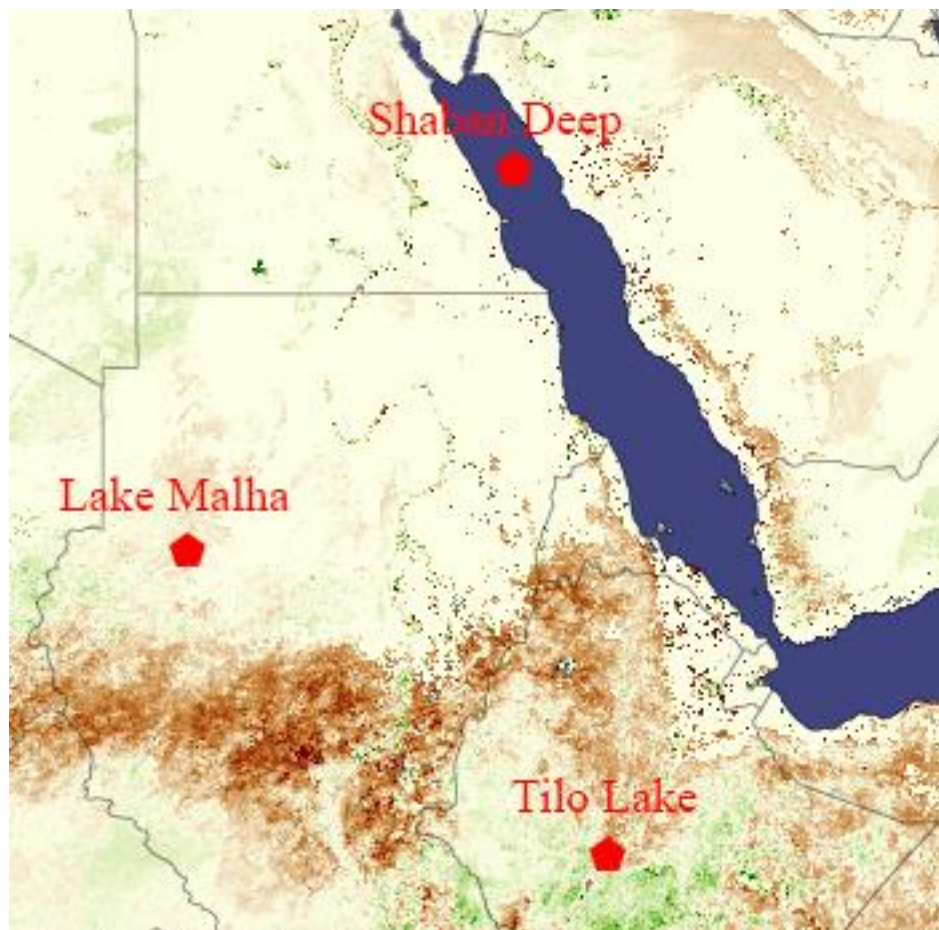


Figure 9-2: A map of the Northeast Africa and the Red Sea Basin (original image courtesy of NASA), depicting the approximate location of proxy records discussed in the text.

Chapter 10: Stable Isotope Analysis of Archaeological Samples

Up to now, this dissertation has consisted primarily of a review of background information concerning the natural setting, the archaeological evidence for the Early Bronze Age in northern Mesopotamia and the Karababa Basin, the principles of stable isotope analysis, and a substantial selection of paleoclimatic proxy evidence for regional climate trends during the 3rd millennium BC. In this chapter, however, I will present the results of the stable isotope analysis that was conducted to assess the diachronic development of 3rd millennium local paleoclimate trends in the Karababa Basin, and to reconstruct the paleodiet of the residents of Titriş Höyük over the course of the Early Bronze Age. To my knowledge, this is the first-ever collection of stable isotope data for the Early Bronze Age to be obtained from this sector of the Turkish Euphrates Valley. But more importantly, the data discussed below also provide the first empirical evidence for late 3rd millennium aridification in the Karababa Basin, and its impacts upon the ancient peoples of this region during the Late EBA. These results, therefore, constitute a significant contribution to the multicausal model I will present concerning the political collapse of Titriş Höyük in the next chapter.

10.1: Materials

All 18 samples of human bone analyzed in this study were obtained from the site of Titriş Höyük. 17 of these were taken from sections of long bone diaphyseal shafts. One sample (AS #0553; TH #63213) was instead obtained from a section of

rib. All three of the Early Bronze Age occupations phases at Titriş Höyük are represented within the human bone samples, with the Late EBA period being best represented ($n=12$), the Mid EBA somewhat less so ($n=5$), and the Early EBA having only one individual. Early and Late EBA remains were excavated from cist or pot burials within the settlement itself, while those of Mid EBA date were recovered from the extramural cemetery to the north of the site, which was employed for burials during this occupation phase (see Table 10-1).

In addition to the 18 human bone samples described above, a further 68 archaeological samples of faunal tooth enamel were also analyzed in the course of this research. Whereas the human bone samples all originated from Titriş Höyük, the faunal enamel samples analyzed here come from three different sites in the study area: Titriş Höyük ($n=42$), Gritille Höyük ($n=21$), and Hacinebi ($n=5$)³³. As was the case with the human skeletal material, all three periods of the Early Bronze Age are represented in the faunal remains from these sites. Due to the limited availability of material for sampling, the relative distribution of samples per period was not uniform; all samples from Hacinebi date to the Early EBA, while the majority of Gritille samples date to the Early or Mid EBA, whereas those from Titriş Höyük date primarily to the Mid and Late EBA periods (see Table 10-2).

³³ Hacinebi is not, strictly speaking, a part of the Karababa Basin, but falls within the study area.

10.2: Methods

10.2.1: Collagen preparation. The preparation of bone collagen samples was undertaken at the University of California, San Diego (UCSD) in the Anthropology Department's Paleodiet Laboratory, following procedures similar to those of Sealy (1986) and Schoeninger *et al.* (1989). Bone samples were first reduced to small fragments (~2 mm). Thereafter, they were demineralized for several weeks with 0.25M hydrochloric acid (HCl), and humic acids were removed by treatment with 0.125M sodium hydroxide (NaOH). Collagen gelatin samples were lyophilized and isotopic analyses of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ were performed on a Costech 4010 EA attached to a Thermo-Finnigan Delta XP Plus mass spectrometer at Scripps Institute for Oceanography's Analytical Facility (managed by Dr. Bruce Deck). Carbon isotope ratios are presented relative to the PDB international standard, and nitrogen isotope ratios are presented relative to AIR.

10.2.2: Bone and enamel bioapatite preparation. Bone and enamel apatite preparation followed procedures similar to those of Koch *et al.* (1997). Samples were finely powdered in an agate mortar and pestle and treated with 0.4 mL of 2% bleach (NaOCl). For each milligram of bone, 0.04 mL of 2% NaOCl was added to the 2 mL centrifuge tube containing the bone powder. Samples were next mixed on a mini-vortexer for 60 seconds before being left at room temperature for 24 hours. Thereafter, the treated samples were rinsed with double-distilled deionized water. Next, for each milligram of bone powder, 0.04 mL of 0.1M acetic acid (CH_3COOH) was added to the centrifuge tubes. These were then mixed on a mini-vortexer for 60 seconds, and

subsequently left at room temperature for 24 hours. Finally, the treated samples were rinsed with double-distilled deionized water again, and then dried at 50° C in a laboratory oven for 24 hours. Before being combusted, all of the human bone apatite samples underwent ATR-FTIR spectral analysis, which was conducted in the Sailor Laboratory of the UCSD Chemistry Department. Finally, as was the case with the bone collagen samples, stable isotope analysis of structural carbonate was conducted on a Gas Bench Thermo MAT 253 connected to a Thermo-Finnigan Delta XP Plus mass spectrometer located at the SIO Analytical Facility. Carbon and oxygen isotope ratios for bone or enamel bioapatite are presented here relative to the PDB international standard.

10.3: Results

10.3.1: Human bone collagen. Unfortunately, poor perseveration has seriously limited the availability of collagen isotope results. Of the eighteen individuals sampled, only six – one of Early EBA date (AS-0544), and five from the Late EBA (AS-0550; AS-0551; AS-0552; AS-0554; and AS-0555) – yielded usable collagen for isotopic analysis (see Table 10-3). Of the six viable collagen samples, one, AS-0554, has a low collagen yield (0.7), and a high C/N ratio (4.5). Although it has been included in this analysis, its reported $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ values must be considered suspect, as will be discussed below.

The $\delta^{13}\text{C}_{(\text{coll})}$ values for the six viable collagen samples fall between -21.1‰ (AS-0554) and -18.4‰ (AS-0544),³⁴ while a mean $\delta^{13}\text{C}_{(\text{coll})}$ value of -19.5‰ (see Table 10-4). $\delta^{15}\text{N}_{(\text{coll})}$ values range from +6.8‰ (AS-0551) to +7.8‰ (AS-0555); the reported mean $\delta^{15}\text{N}_{(\text{coll})}$ value is +7.4‰. If Sample AS-0554 is removed because of its low $\delta^{13}\text{C}_{(\text{coll})}$ value, which is an outlier from the rest of the sample, then the overall mean $\delta^{13}\text{C}_{(\text{coll})}$ value instead becomes -19.1‰; the mean for $\delta^{15}\text{N}_{(\text{coll})}$ remains +7.4‰. Among the five Late EBA samples, the mean $\delta^{13}\text{C}_{(\text{coll})}$ value is -19.7‰, and the mean $\delta^{15}\text{N}_{(\text{coll})}$ value +7.4‰.

The carbon and nitrogen stable isotope values for the human bone collagen samples generally form a fairly tight group. The range of $\delta^{15}\text{N}_{(\text{coll})}$ values is roughly 1.0‰, while for $\delta^{13}\text{C}_{(\text{coll})}$ all values falls within a 1.1‰ range apart from the notable exception of the aberrant $\delta^{13}\text{C}_{(\text{coll})}$ value for AS-0554 (see Figure 10-1). It is not possible to construct any diachronic trends in sampled carbon or nitrogen isotope ratios from this limited sample, but it should be noted that the $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ values for the single Early EBA sample (AS-0544) fall within the same range of values as the five Late EBA samples. Theoretically, if this pattern were to hold for a statistically significant sample population, then given that protein “acts as the major determinant of $\delta^{13}\text{C}_{\text{collagen}}$ ” (Froehle *et al.*, 2010: 2669), one possible interpretation might be that the dietary protein sources for the Early and Late EBA periods were generally similar, although that would also necessarily depend upon other factors, such as how protein-rich the diet was for the residents of Titriş Höyük.

³⁴ If AS-0554 is excluded, the range of $\delta^{13}\text{C}_{(\text{coll})}$ values is more constrained, with the lowest being -19.6‰ (AS-0555), and the highest being -18.4‰ (AS-0544).

10.3.2: Tıtrıř Höyük human bone bioapatite. Unlike the collagen samples, $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$ values were successfully obtained from all 18 of the human bone carbonate samples. All three phases of occupation at Tıtrıř Höyük are therefore represented in the results (although for the Early EBA period there is only a single sample).

Given the age of the skeletal tissues and the poor preservation of collagen in the majority of the human bone samples, before presenting the results of the stable carbon and oxygen isotope analysis for the Tıtrıř human bone samples, it is necessary to first address the possibility of diagenetic contamination of the bone apatite. At first glance, the IR-SF values of the ATR-FTIR spectra appear to be slightly high (see Table 10-5). While this would be a warning sign of possible contamination of the apatite if these samples had been analyzed using “traditional” Kbr-FTIR, Hollund *et al.* report that IR-SF values for ATR spectra of a given bone apatite sample are, on average, roughly 0.5 higher than the Kbr spectra IR-SF values for the same sample (cf. Hollund *et al.*, 2013: 519). Thus, IR-SF values analyzed using ATR-FTIR that fall between 3.0 and 4.0 should not be considered a sign that a given apatite sample has suffered diagenetic contamination. Moreover, the C/P ratios of all bone bioapatite samples also fall within acceptable ranges. It appears unlikely, therefore, that the isotope values obtained for the samples of human bone carbonate have been affected by diagenetic alteration.

For the overall sample, $\delta^{13}\text{C}_{(\text{apa})}$ values for the human bone samples range between -13.1‰ (AS-0550) and -9.8‰ (AS-0538) (see Table 10-6 and Figure 10-2);

the overall mean for all samples is -11.5‰ (see Table 10-7). The mean $\delta^{13}\text{C}_{(\text{apa})}$ values by period are shown in Table 10-6. The overall $\delta^{18}\text{O}_{(\text{apa})}$ values for the entire human bone sample set fall between -6.2‰ (AS-0546) and -3.8‰ (AS-0550), while the mean $\delta^{18}\text{O}_{(\text{apa})}$ value for the entire sample is -4.9‰. The mean $\delta^{18}\text{O}_{(\text{apa})}$ values for each phase of Early Bronze Age occupation at Titriş Höyük are also displayed in Table 10-7.

What is immediately striking about the results of the stable carbon and oxygen isotope analysis of the human bioapatite is the clear separation between the Mid and Late EBA periods for both $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$. This is plainly visible in Figure 10-2. That the differences in both the $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$ values for the Mid EBA and Late EBA periods are statistically significant was also confirmed by the results of a Mann-Whitney U Test, as shown in Table 10-8.

10.3.3: Karababa ovicaprid enamel bioapatite. In addition to the human bioapatite samples from Titriş Höyük, stable carbon and oxygen isotope analysis was also conducted on archaeological samples of ovicaprid tooth enamel from Titriş, Gritille Höyük, and Hacinebi. The results are shown in Table 10-9 and Figure 10-3. The overall mean $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values for each site are as follows: -10.0‰ and -1.9‰ (Titriş); -10.7‰ and -2.5‰ (Gritille); and -10.4‰ and -2.7‰ (Hacinebi). The mean $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values are a clear indication that the stable oxygen and carbon isotope compositions of tooth enamel from all three sites are broadly similar.

In the Gritille Höyük and Titriş Höyük samples, four different types of tooth were employed in this analysis: M2 and M3 molars, and PM3 and PM4 premolars.

Accordingly, it is important to establish whether any significant differences exist in the isotopic composition of each tooth type. As Table 10-10 shows, however, the mean $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values for each tooth type at both sites are generally very similar, especially for $\delta^{13}\text{C}_{(\text{en})}$. $\delta^{18}\text{O}_{(\text{en})}$ values exhibit a slightly wider variation, but this is largely an artifact of the fact that only one PM3 and PM4 from the Gritille Höyük faunal collection was analyzed in this study. Given the fairly close range of $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values for each tooth type, it seems therefore unlikely that tooth type has a significant effect on the isotopic composition of the ovicaprid teeth analyzed in this study.

Table 10-11 shows a breakdown of the mean $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values for each period at each site. As Figure 10-3 shows, there is no clear pattern discernible in the Hacinebi faunal isotope data. This may simply be an artifact of the small sample size. Another possibility the fact that the site was situated very close to the Euphrates river; given that Hacinebi is located to the south of the Karababa (close to the modern Turkish-Syrian border) it may have been the case that these ovicaprid flocks were kept near the river because conditions in this area were more marginal than in the Karababa. Whatever the reason, given that all of the Hacinebi samples are of Early EBA date, and that they present no clear indication of conditions in the region, the Hacinebi results appear to tell us little about the climate history of the Turkish Euphrates Valley during the 3rd millennium BC.

It is also difficult to discern any clear pattern from the results for the two Karababa Basin sites. At Gritille Höyük, both $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ are slightly lower

during the Mid EBA than during the Early or Late EBA (although given that there are only 3 samples for the Late EBA at Gritille, the results for this period should be viewed with caution). Interestingly, at Titriş Höyük, the opposite is true. Indeed, the relative change in mean $\delta^{13}\text{C}_{(\text{en})}$ or $\delta^{18}\text{O}_{(\text{en})}$ values over the course of the three EBA periods at Titriş Höyük and Gritille Höyük appear to suggest opposite trends: relative enrichment in both heavy isotope species during the Mid EBA at Titriş on the one hand, and relative depletion in both during that same period at Gritille on the other. However, the results of an ANOVA Test show that at both Titriş and Gritille, the $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ differences for all three periods were not statistically significant (see Tables 10-12 and 10-13, respectively). This finding therefore stands in stark contrast to the results of the human bone carbonate isotope analysis discussed above. I will address the possible reasons for this, and their archaeological implications, below.

10.4: Discussion

10.4.1: Human paleodiet at Early Bronze Age Titriş Höyük. In general, the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for the human collagen and bioapatite samples agree well with the archaeological evidence for human diet, both at Titriş Höyük and throughout northern Mesopotamia as a whole. Given that the major crops of ancient Upper Mesopotamia are all C_3 plants, the $\delta^{13}\text{C}_{(\text{apa})}$ values for all periods, and especially the Mid EBA, are relatively high. However, the results of a carbon isotope analysis conducted by Riehl *et al.* (cf. 2008: Table 1) clearly show that the $\delta^{13}\text{C}$ values of Bronze Age grain fragments from Turkey, Syria, the Levant, and Spain are

consistently higher than the global average for C₃ plants – most tend to fall between -23‰ and -21‰. Using the data they report for Bronze Age barley and wheat from Syrian sites, for example, I calculate that the mean $\delta^{13}\text{C}$ value for both species is -22.6‰. Consequently, the somewhat high $\delta^{13}\text{C}_{(\text{apa})}$ values in the Titriş Höyük bone carbonate samples appear to confirm that cereals were indeed the primary staple food of ancient Titriş Höyük, particularly during the city's Mid EBA apogee.

The $\delta^{15}\text{N}_{(\text{coll})}$ values also indicate it is likely – but by no means certain – that meat constituted a fairly important component of the local diet of Late EBA Titriş Höyük. The human collagen samples from Titriş are enriched in ¹⁵N in comparison to the $\delta^{15}\text{N}_{(\text{coll})}$ values for domesticated animals reported by Trella (see Table 10-14), which suggests that these individuals were probably omnivorous. It is also possible that meat became increasingly important to the local subsistence strategy over the course of the millennium; while the $\delta^{15}\text{N}_{(\text{coll})}$ values for the Early EBA (which admittedly is based upon a single individual) and the Late EBA are roughly the same, Early EBA animals appear to have been enriched in ¹⁵N in comparison with later periods. However, because increased aridity can cause ¹⁵N enrichment in plant tissues, it is also possible that the consumption of meat actually declined in importance, but the $\delta^{15}\text{N}_{(\text{coll})}$ values do not reflect this because of the climatically-induced ¹⁵N enrichment in crops.

Although the carbon and nitrogen isotope results for collagen samples hint at the possibility that the dietary protein sources for the Late EBA people of Titriş Höyük may have been fairly homogenous, the results of the human bioapatite isotope indicate

that the overall composition of human diet was actually quite variable during this period. This can be readily observed in the range of $\delta^{13}\text{C}_{(\text{apa})}$ values from the Late EBA, which is rather broad in comparison to the comparatively constrained Mid EBA $\delta^{13}\text{C}_{(\text{apa})}$ values (see Figure 10-3). Because the mean $\delta^{13}\text{C}_{(\text{apa})}$ value for the Late EBA is lower than that of the Mid EBA, this also suggests that cereal crops, though still an important component of local diet, were less central to subsistence than they had been during the Mid EBA.

The $\delta^{13}\text{C}_{(\text{apa})}$ values for the Mid and Late EBA periods appear to support Wattenmaker's hypothesis that the character of human diet in the Early Bronze Age urban centers of northern Mesopotamia at any given time was largely dependent on their level of political and economic centralization (Wattenmaker 1998).

Wattenmaker argues that agricultural production in the Karababa became increasingly specialized during the Mid and Late EBA because of the growing tributary demands of the central authorities from households and the agricultural hinterland increased in order to support a growing population (*ibid*: 187-189). The relatively tight cluster of $\delta^{13}\text{C}_{(\text{apa})}$ values for the Mid EBA period – when the state reached its zenith, and thus presumably exerted its greatest influence over the region – in comparison with the wider range of $\delta^{13}\text{C}_{(\text{apa})}$ values for the Late EBA may therefore be partly an artifact of the relative hegemonic strength of the central state during various periods of the Early Bronze Age. However, as I will discuss below, environmental change probably also influenced the amount of variation present in the Mid and Late EBA $\delta^{13}\text{C}_{(\text{apa})}$ values.

Given the ambiguous nature of the Late EBA $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ values, it is unclear whether or not the isotope ratios for the human collagen samples also support Wattenmaker's hypothesis. This issue could potentially be resolved, however, by obtaining a larger set of carbon and nitrogen isotope ratios from further collagen samples of Mid EBA date, which would facilitate a comparison with the Late EBA.

10.4.2: Isotopic proxy evidence for 3rd millennium paleoclimate trends in the Karababa Basin. The stable carbon and oxygen isotope data discussed above are more equivocal concerning the local 3rd millennium climate history of the Karababa Basin than the paleodiet of its human inhabitants. On the one hand, the human bone carbonate samples provide a strong indication that local hydroclimatological conditions in the vicinity of Titriş Höyük became measurably more arid during the final three centuries of the millennium. This inference can be drawn from the relative ^{18}O observed in the Late EBA samples in comparison with those of the Middle EBA. On the other hand, no such statistically significant Late EBA ^{18}O enrichment can be observed in the faunal stable oxygen isotope data from Titriş or Gritille Höyük.

There are three alternative explanations that can best explain this disparity between the human and faunal isotopic proxy records. In the first scenario, paleoclimatic conditions in the Karababa Basin did become drier during the late 3rd millennium BC. This trend towards greater aridity is reflected in the oxygen isotope ratios of human bioapatite from Titriş Höyük because the settled human population of the city was located at a fixed point at some distance from the Euphrates, and was therefore impacted directly by the drier climate. But because the ovicaprid flocks

being cared for by nomadic pastoralist groups (see the discussion in Chapter 4) were mobile, they were able to seek out reliable sources of water, and were thus not greatly affected by the climatic shift. In the second scenario, the climate of the Karababa Basin did not experience any substantial change during the late 3rd millennium BC. Consequently, because conditions remained stable, the ovicaprid remains exhibit no statistically significant enrichment in ¹⁸O at any point during the course of the millennium. In this scenario, the Late EBA ¹⁸O enrichment that can be observed in the human bone bioapatite from Tıtrıř would have resulted from another cause: the drying up of the Tıtrıř ay during the Late EBA (see Chapter 6), which altered the local hydrological regime substantially enough to be recorded in the isotope ratios of Late EBA humans. Finally, it is also equally plausible that both a change in climate *and* the loss of the Tıtrıř ay were the cause of the ¹⁸O enrichment in the Late EBA human bone bioapatite.

The available stable oxygen isotope evidence does lean obviously towards any of the scenarios described above, but I am slightly inclined toward those that suggest that a substantial although not necessarily catastrophic degree of aridification was experienced in the Karababa Basin during the late 3rd millennium BC. As I discussed above, the relatively low mean $\delta^{13}\text{C}_{(\text{apa})}$ value for the Late EBA in the Tıtrıř bioapatite is likely an indication of a reduced reliance upon cereal crops. Given the relatively low drought tolerance of cereals – especially emmer wheat – it is possible that drier conditions during the Late EBA were partly responsible for the reduced emphasis on grains in the Tıtrıř subsistence economy that is indicated by the carbon isotope data.

If precipitation levels remained similar to those of the Mid EBA, it seems unlikely that the silting up of the Tıtrıř Çay would, in and of itself, have caused a notable reduction in crop yields for cereals, as the city almost certainly utilized dry farming as its primary mode of agricultural production.

Moreover, the overall climatic trend of increased Late EBA aridity depicted in the $\delta^{18}\text{O}_{(\text{apa})}$ values agrees well with a majority of the paleoclimatic proxy evidence discussed in Chapters 8 and 9. This does not necessarily mean that the drier conditions suggested by the oxygen isotope evidence from Tıtrıř Hyk should automatically be connected to regional climatic fluctuations, or to the 4.2 ka BP event; as I have repeatedly stressed in this study, it is dangerous to extrapolate local conditions from proxies in other parts of the Near East. Having said that, however, it cannot be ignored that the relative similarity of the climatic trend observed in the $\delta^{18}\text{O}_{(\text{apa})}$ values does agree well with other proxy evidence for late 3rd millennium aridification in the Near East and the Eastern Mediterranean Basin. Accordingly, while other records do not “prove” that the Karababa Basin experienced a shift towards drier conditions during the late 3rd millennium, they do at least provide some further circumstantial support to suggest that these data are probably indicative of such a shift.

10.4.3: Is there isotopic evidence of climate change impacts upon the subsistence economies of Late EBA cities in the Karababa Basin? If we accept the climatic interpretation of the $\delta^{18}\text{O}_{(\text{apa})}$ values I have just proposed above, then the stable carbon isotope ratios from the human bioapatite samples reported above can be

interpreted as evidence that the onset of relatively arid conditions during the Late EBA had some impact upon the agricultural output of the city, particularly in the case of grain. In light of the archaeobotanical evidence for continued emmer wheat and barley cultivation at Late EBA Titriş Höyük discussed in Chapter 6, the stable isotope evidence seems to suggest that drier conditions probably reduced crop yields for cereals to some extent, but not enough to result in a drastic change in diet. Rather, the people of Late EBA Titriş Höyük probably continued to grow wheat and barley, but supplemented these crops to a larger extent with other plant-based foods. Whether this new subsistence strategy might have included a foraging component is not possible to determine from the available data, but it is a possibility that bears further investigation in the future.

Interestingly, while the isotope evidence from the human remains appears to suggest that climate change did impact the Karababa Basin and its settled agricultural populations, for whatever reason the city's mobile herds of domesticated ovicaprids do not appear to have been significantly affected by drier conditions. Although it is not clear why this was the case from the available evidence, I suspect that the migratory herding patterns of these animals are largely responsible. Either the pastoralists tending these animals were still able to find sources of fresh water for them in existing pasturelands, or else they simply herded the flocks further afield to places where the supply of water was more readily available. Although this the evidence for this is admittedly circumstantial, given the comparatively large range of Late EBA $\delta^{13}\text{C}_{(\text{en})}$ values of the Titriş Höyük ovicaprids that can be observed in Figure 10-3, which

suggests a wider range of plant foods ingested by these animals (or possibly an enrichment in ^{13}C in the tissues of some plant species due to drought), I suspect that the latter was probably the case – the search for adequate pastureland probably resulted in wider migratory circuits for ovicaprid flocks during the Late EBA than during the Early or Mid EBA. Either way, the stable isotope evidence from the human remains of Titriş Höyük does appear to suggest that a moderate to severe climatic deterioration during the late 3rd millennium BC probably had some impact on the viability of dry farming in the vicinity of Titriş Höyük, but that of the faunal tooth enamel suggests that this development apparently had little impact upon the pastoral economies of Late EBA Karababa cities.

Table 10-1: Samples of Titriş Höyük Human Bone Analyzed in this Study.

Sample #	TH #	Trench #	Period	Burial Type
AS-0538	5520	40-34	Early EBA	Cist
AS-0540	840	35-18	Late EBA	Pot
AS-0541	848	35-18	Late EBA	Pot
AS-0542	849	35-18	Late EBA	Pot
AS-0543	927	35-18	Late EBA	Pot
AS-0544	4489	69-55	Late EBA	N/A
AS-0545	14110	79-85	Late EBA	Cist
AS-0546	60538	34-11N	Late EBA	Pit
AS-0547	62636	35-10N	Late EBA	Cist/Pot
AS-0548	63202	36-10	Late EBA	Cist
AS-0549	63213	36-10N	Late EBA	Cist
AS-0550	65165	34-13N	Late EBA	N/A
AS-0551	80071	82-87	Late EBA	Plaster Basin
AS-0552	7521	Cemetery 2	Mid EBA	Cist
AS-0553	7533	Cemetery 2	Mid EBA	Cist
AS-0554	7556	Cemetery 2	Mid EBA	Cist
AS-0555	7581	Cemetery 3	Mid EBA	Cist
AS-0556	7628	Cemetery 4	Mid EBA	Cist

Table 10-2: Samples of Faunal Tooth Enamel from the Sites of Titriş Höyük (TH), Gritille Höyük (GH), and Hacinebi (HN) Analyzed in this Study.

Site	AS-#	Period	Species	Element
TH	AS-0514	Early EBA	Ovicaprid	PM4
TH	AS-0515	Early EBA	Ovicaprid	PM4
TH	AS-0516	Mid EBA	Ovicaprid	M2
TH	AS-0517	Mid EBA	Ovicaprid	M3
TH	AS-0518	Mid EBA	Ovicaprid	M3
TH	AS-0519	Mid EBA	Ovicaprid	PM4
TH	AS-0520	Late EBA	Ovicaprid	M2/M3
TH	AS-0521	Late EBA	Ovicaprid	M3
TH	AS-0522	Late EBA	Ovicaprid	M2
TH	AS-0523	Late EBA	Ovicaprid	M2
TH	AS-0524	Early EBA	Ovicaprid	M2
TH	AS-0525	Early EBA	Ovicaprid	M2
TH	AS-0526	Mid EBA	Ovicaprid	M3
TH	AS-0527	Mid EBA	Ovicaprid	M2
TH	AS-0528	Mid EBA	Ovicaprid	Multiple
TH	AS-0529	Mid EBA	Ovicaprid	M3
TH	AS-0530	Mid EBA	Ovicaprid	M3
TH	AS-0531	Mid EBA	Ovicaprid	M3
TH	AS-0532	Late EBA	Capra	M2
TH	AS-0533	Late EBA	Capra	Multiple
TH	AS-0534	Late EBA	Ovicaprid	M2
TH	AS-0535	Late EBA	Ovicaprid	M2
TH	AS-0536	Late EBA	Ovicaprid	M2(?)
TH	AS-0537	Late EBA	Ovicaprid	M3
TH	AS-0557	Early EBA	Ovicaprid	PM3
TH	AS-0559	Mid EBA	Ovicaprid	PM4
TH	AS-0560	Mid EBA	Ovicaprid	PM4
TH	AS-0561	Mid EBA	Ovicaprid	M3
TH	AS-0562	Mid EBA	Ovicaprid	M2(?)
TH	AS-0563	Early EBA	Ovicaprid	PM3
TH	AS-0564	Late EBA	Ovicaprid	M2
TH	AS-0565	Late EBA	Ovicaprid	M2
TH	AS-0566	Late EBA	Ovicaprid	M2
TH	AS-0567	Late EBA	Ovicaprid	M2
TH	AS-0568	Late EBA	Ovicaprid	M2
TH	AS-0569	Late EBA	Ovicaprid	PM4
TH	AS-0570	Late EBA	Ovicaprid	PM4

Table 10-2: Samples of Faunal Tooth Enamel from the Sites of Titriş Höyük (TH), Gritille Höyük (GH), and Hacinebi (HN) Analyzed in this Study, continued.

Site	AS-#	Period	Species	Element
TH	AS-0571	Late EBA	Ovicaprid	PM3
TH	AS-0572	Late EBA	Ovicaprid	PM4
TH	AS-0574	Late EBA	Ovicaprid	PM4
GH	AS-0597	Early EBA	Ovicaprid	M2
GH	AS-0598	Early EBA	Ovicaprid	M3
GH	AS-0606	Early EBA	Ovicaprid	M2
GH	AS-0609	Early EBA	Ovicaprid	M2
GH	AS-0614	Early EBA	Ovicaprid	M2
GH	AS-0621	Early EBA	Ovicaprid	M3
GH	AS-0623	Early EBA	Ovicaprid	M2
GH	AS-0624	Early EBA	Ovicaprid	M2
GH	AS-0627	Early EBA	Ovicaprid	M3
GH	AS-0631	Early EBA	Ovicaprid	M3
GH	AS-0586	Mid EBA	Bos	M3
GH	AS-0589	Mid EBA	Ovicaprid	M3
GH	AS-0591	Mid EBA	Ovicaprid	M2
GH	AS-0593	Mid EBA	Ovicaprid	M3
GH	AS-0595	Mid EBA	Ovicaprid	M3
GH	AS-0596	Mid EBA	Ovicaprid	M3
GH	AS-0641	Mid EBA	Ovicaprid	M2
GH	AS-0642	Mid EBA	Ovicaprid	PM3/PM4
GH	AS-0639	Late EBA	Ovicaprid	M2
GH	AS-0640	Late EBA	Ovicaprid	M2
GH	AS-0643	Late EBA	Ovicaprid	PM(?)
HN	AS-0575	Early EBA	Ovicaprid	M2
HN	AS-0576	Early EBA	Ovicaprid	M2
HN	AS-0577	Early EBA	Ovicaprid	M2
HN	AS-0579	Early EBA	Ovicaprid	M2
HN	AS-0580	Early EBA	Ovicaprid	M2

Table 10-3: $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ Results for All Titriş Höyük Human Bioapatite Samples.

Sample	Period	%C	%N	$\delta^{13}\text{C}_{(\text{coll})}$	$\delta^{15}\text{N}_{(\text{coll})}$	C/N	Col Yield %
AS-0544	Early EB	38.4	13.9	-18.4‰	+7.7‰	3.2	8.0
AS-0550	Late EB	41.6	15.0	-19.1‰	+7.3‰	3.2	4.2
AS-0551	Late EB	40.6	14.7	-19.5‰	+6.8‰	3.2	3.7
AS-0552	Late EB	41.1	14.6	-19.1‰	+7.2‰	3.3	1.6
AS-0554	Late EB	8.8	2.3	-21.1‰	+7.7‰	4.5	0.7
AS-0555	Late EB	35.2	12.4	-19.6‰	+7.8‰	3.3	2.9

Table 10-4: Mean, Maximum and Minimum $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ Values for Human Collagen Samples from Titriş Höyük.

Period & Site	Sample Size	Mean $\delta^{13}\text{C}_{(\text{coll})}$	Max $\delta^{13}\text{C}_{(\text{coll})}$	Min $\delta^{13}\text{C}_{(\text{coll})}$	Mean $\delta^{15}\text{N}_{(\text{coll})}$	Max $\delta^{15}\text{N}_{(\text{coll})}$	Min $\delta^{15}\text{N}_{(\text{coll})}$
Early EBA	1	-18.4‰	-18.4‰	-18.4‰	+7.7‰	+7.7‰	+7.7‰
Mid EBA	0	N/A	N/A	N/A	N/A	N/A	N/A
Late EBA	5	-19.7‰	-19.1‰	-21.1‰	+7.4‰	+7.8‰	+6.8‰

Table 10-5: Results of ATR-FTIR Analysis of Samples of Human Bone Carbonate from Titriş Höyük.

Sample No.	TH #	Period	C/P Ratio	IR-SF
AS-0538	5520	Early EBA	0.1	3.21
AS-0552	7521	Mid EBA	0.1	3.63
AS-0553	7533	Mid EBA	0.1	3.35
AS-0554	7556	Mid EBA	0.1	3.42
AS-0555	7581	Mid EBA	0.1	3.11
AS-0556	7628	Mid EBA	0.1	3.19
AS-0540	840	Late EBA	0.2	2.96
AS-0541	848	Late EBA	0.2	3.83
AS-0542	849	Late EBA	0.2	2.75
AS-0543	927	Late EBA	0.1	3.47
AS-0544	4489	Late EBA	0.1	3.50
AS-0545	14110	Late EBA	0.1	3.63
AS-0546	60538	Late EBA	0.2	3.09
AS-0547	62636	Late EBA	0.2	3.12
AS-0548	63202	Late EBA	0.1	3.51
AS-0549	63213	Late EBA	0.1	3.86
AS-0550	65165	Late EBA	0.1	3.58
AS-0551	80071	Late EBA	0.2	3.19

Table 10-6: $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$ Results for All Titriş Höyük Human Bioapatite Samples.

Sample #	Period	$\delta^{13}\text{C}_{(\text{apa})}$	$\delta^{18}\text{O}_{(\text{apa})}$	C/P Ratio	IR-SF
AS-0538	Early EBA	-12.7‰	-4.7‰	0.1	3.21
AS-0540	Late EBA	-10.8‰	-4.6‰	0.2	2.96
AS-0541	Late EBA	-11.3‰	-5.0‰	0.1	3.83
AS-0542	Late EBA	-12.6‰	-3.9‰	0.2	2.75
AS-0543	Late EBA	-11.7‰	-5.0‰	0.1	3.47
AS-0544	Late EBA	-12.0‰	-4.4‰	0.1	3.5
AS-0545	Late EBA	-12.8‰	-5.3‰	0.1	3.63
AS-0546	Late EBA	-13.1‰	-3.8‰	0.2	3.09
AS-0547	Late EBA	-12.9‰	-4.2‰	0.2	3.12
AS-0548	Late EBA	-9.5‰	-4.8‰	0.1	3.51
AS-0549	Late EBA	-12.9‰	-5.3‰	0.1	3.86
AS-0550	Late EBA	-11.6‰	-4.4‰	0.1	3.58
AS-0551	Late EBA	-10.9‰	-5.4‰	0.2	3.19
AS-0552	Mid EBA	-9.8‰	-5.3‰	0.1	3.63
AS-0553	Mid EBA	-11.4‰	-6.0‰	0.1	3.35
AS-0554	Mid EBA	-10.6‰	-6.2‰	0.1	3.42
AS-0555	Mid EBA	-10.3‰	-5.6‰	0.1	3.11
AS-0556	Mid EBA	-10.6‰	-4.9‰	0.1	3.19

Table 10-7: Mean, Maximum and Minimum $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$ Values for Human Bioapatite Samples from Titriş Höyük.

Period & Site	Sample Size	Mean $\delta^{13}\text{C}_{(\text{apa})}$	Max $\delta^{13}\text{C}_{(\text{apa})}$	Min $\delta^{13}\text{C}_{(\text{apa})}$	Mean $\delta^{18}\text{O}_{(\text{apa})}$	Max $\delta^{18}\text{O}_{(\text{apa})}$	Min $\delta^{18}\text{O}_{(\text{apa})}$
<i>Early EBA</i>	1	-12.7‰	-12.7‰	-12.7‰	-4.7‰	-4.7‰	-4.7‰
<i>Mid EBA</i>	5	-10.5‰	-9.8‰	-11.4‰	-5.6‰	-4.9‰	-6.2‰
<i>Late EBA</i>	12	-11.8‰	-9.5‰	-13.1‰	-4.7‰	-3.8‰	-5.4‰

Table 10-8: Results of the Mann-Whitney U Test for the Mid EBA and Late EBA Titriş Höyük Human Bioapatite Samples.

Isotope Type	Asymptotic Sig. ($\alpha = .05$)	Exact Sig. ($\alpha = .05$)
$\delta^{13}\text{C}_{(\text{apa})}$.020	.019
$\delta^{18}\text{O}_{(\text{apa})}$.015	.014

Table 10-9: $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ Results for All Study Area Faunal Enamel Samples.

Site	AS-#	Period	$\delta^{13}\text{C}_{(\text{en})}$	$\delta^{18}\text{O}_{(\text{en})}$
TH	AS-0514	Early EBA	-10.4‰	-4.3‰
TH	AS-0515	Early EBA	-10.6‰	-0.9‰
TH	AS-0516	Mid EBA	-11.8‰	-2.8‰
TH	AS-0517	Mid EBA	-10.0‰	-1.2‰
TH	AS-0518	Mid EBA	-8.0‰	-0.6‰
TH	AS-0519	Mid EBA	-9.4‰	+0.0‰
TH	AS-0520	Late EBA	-9.7‰	+0.9‰
TH	AS-0521	Late EBA	-10.8‰	-2.2‰
TH	AS-0522	Late EBA	-9.2‰	-3.2‰
TH	AS-0523	Late EBA	-7.4‰	-2.1‰
TH	AS-0524	Early EBA	-10.4‰	-4.4‰
TH	AS-0525	Early EBA	-8.2‰	+0.5‰
TH	AS-0526	Mid EBA	-8.5‰	-1.6‰
TH	AS-0527	Mid EBA	-10.0‰	-2.7‰
TH	AS-0528	Mid EBA	-7.8‰	+0.3‰
TH	AS-0529	Mid EBA	-9.4‰	+0.1‰
TH	AS-0530	Mid EBA	-8.4‰	-2.2‰
TH	AS-0531	Mid EBA	-8.3‰	+0.5‰
TH	AS-0532	Late EBA	-11.1‰	-3.3‰
TH	AS-0533	Late EBA	-9.5‰	-2.4‰
TH	AS-0534	Late EBA	-9.0‰	-3.4‰
TH	AS-0535	Late EBA	-9.5‰	-2.7‰
TH	AS-0536	Late EBA	-8.4‰	-2.4‰
TH	AS-0537	Late EBA	-8.9‰	-0.9‰
TH	AS-0557	Early EBA	-10.4‰	-4.6‰
TH	AS-0559	Mid EBA	-10.0‰	-1.1‰
TH	AS-0560	Mid EBA	-9.9‰	-1.6‰
TH	AS-0561	Mid EBA	-11.2‰	-2.1‰
TH	AS-0562	Mid EBA	-9.0‰	+2.9‰

Table 10-9: $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ Results for All Study Area Faunal Enamel Samples, continued.

Site	AS-#	Period	$\delta^{13}\text{C}_{(\text{en})}$	$\delta^{18}\text{O}_{(\text{en})}$
TH	AS-0563	Early EBA	-9.7‰	-1.1‰
TH	AS-0564	Late EBA	-10.8‰	-1.5‰
TH	AS-0565	Late EBA	-10.6‰	-3.4‰
TH	AS-0566	Late EBA	-12.3‰	-5.3‰
TH	AS-0567	Late EBA	-13.5‰	-1.5‰
TH	AS-0568	Late EBA	-11.7‰	-3.3‰
TH	AS-0569	Late EBA	-10.2‰	-0.4‰
TH	AS-0570	Late EBA	-12.2‰	-1.0‰
TH	AS-0571	Late EBA	-11.2‰	-3.2‰
TH	AS-0572	Late EBA	-10.7‰	+0.6‰
TH	AS-0574	Late EBA	-9.4‰	-3.2‰
GH	AS-0597	Early EBA	-8.3‰	-3.5‰
GH	AS-0598	Early EBA	-10.6‰	-2.6‰
GH	AS-0606	Early EBA	-10.5‰	-0.3‰
GH	AS-0609	Early EBA	-10.9‰	-2.7‰
GH	AS-0614	Early EBA	-10.6‰	-4.6‰
GH	AS-0621	Early EBA	-9.7‰	-0.3‰
GH	AS-0623	Early EBA	-11.7‰	-1.3‰
GH	AS-0624	Early EBA	-10.7‰	+0.5‰
GH	AS-0627	Early EBA	-9.7‰	-0.7‰
GH	AS-0631	Early EBA	-11.7‰	-5.2‰
GH	AS-0589	Mid EBA	-11.5‰	-4.2‰
GH	AS-0591	Mid EBA	-10.3‰	-5.3‰
GH	AS-0593	Mid EBA	-12.3‰	-2.1‰
GH	AS-0595	Mid EBA	-11.5‰	-2.9‰
GH	AS-0596	Mid EBA	-11.3‰	-0.9‰
GH	AS-0641	Mid EBA	-10.0‰	-2.9‰
GH	AS-0642	Mid EBA	-11.2‰	-2.4‰
GH	AS-0639	Late EBA	-10.1‰	-1.4‰
GH	AS-0640	Late EBA	-10.5‰	-0.2‰
GH	AS-0643	Late EBA	-10.7‰	-3.6‰
HN	AS-0575	Early EBA	-11.8‰	-0.4‰
HN	AS-0576	Early EBA	-11.5‰	-1.2‰
HN	AS-0577	Early EBA	-11.2‰	-3.7‰
HN	AS-0579	Early EBA	-10.0‰	-3.8‰
HN	AS-0580	Early EBA	-6.9‰	-4.2‰
HN	AS-0581	Early EBA	-11.0‰	-3.3‰

Table 10-10: Mean $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ Values of Each Tooth Type for the Gritille Höyük and Tiriş Höyük Sample Populations.

Tooth Type & Site	Sample Size	Mean $\delta^{13}\text{C}_{(\text{en})}$	Mean $\delta^{18}\text{O}_{(\text{en})}$
GH M2	15	-10.2‰	-2.2‰
GH M3	16	-10.5‰	-2.5‰
GH PM3	1	-9.5‰	+2.9‰
GH PM4	1	-10.7‰	-4.2‰
TH M2	14	-10.4‰	-2.8‰
TH M3	10	-9.4‰	-1.4‰
TH PM3	3	-10.4‰	-2.9‰
TH PM4	9	-10.3‰	-1.3‰

Note. Any teeth of indeterminate tooth type were excluded from this analysis.

Table 10-11: Mean, Maximum and Minimum $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ Values of the Stable Carbon and Oxygen Isotope Analysis of Faunal Enamel Samples from Tiriş Höyük, Gritille Höyük, and Hacinebi.

Period & Site	Sample Size	Mean $\delta^{13}\text{C}_{(\text{en})}$	Max $\delta^{13}\text{C}_{(\text{en})}$	Min $\delta^{13}\text{C}_{(\text{en})}$	Mean $\delta^{18}\text{O}_{(\text{en})}$	Max $\delta^{18}\text{O}_{(\text{en})}$	Min $\delta^{18}\text{O}_{(\text{en})}$
<i>Hacinebi Early EBA</i>	6	-10.4‰	-6.9‰	-11.5‰	-2.7‰	-0.4‰	-4.2‰
<i>Gritille Early EBA</i>	10	-10.4‰	-8.3‰	-11.7‰	-2.1‰	+0.5‰	-5.2‰
<i>Gritille Mid EBA</i>	8	-11.1‰	-10.0‰	-12.3‰	-3.4‰	-0.9‰	-6.5‰
<i>Gritille Late EBA</i>	3	-10.4‰	-10.1‰	-10.7‰	-1.7‰	-0.2‰	-3.6‰
<i>Tiriş Early EBA</i>	6	-10.0‰	-8.2‰	-10.6‰	-2.5‰	+0.5‰	-4.6‰
<i>Tiriş Mid EBA</i>	14	-9.5‰	-7.8‰	-11.8‰	-1.1‰	+2.9‰	-2.8‰
<i>Tiriş Late EBA</i>	20	-10.3‰	-7.4‰	-13.5‰	-2.3‰	+0.9‰	-5.3‰

Table 10-12: Results of the ANOVA Test for the Mid EBA and Late EBA Gritille Höyük Faunal Tooth Enamel Samples.

Isotope Type	Sig. ($\alpha = .05$)
$\delta^{13}\text{C}_{(\text{en})}$.220
$\delta^{18}\text{O}_{(\text{en})}$.265

Table 10-13: Results of the ANOVA Test Between Mid and Late EBA Periods for the Tiriş Höyük Faunal Tooth Enamel Samples.

Isotope Type	Sig. ($\alpha = .05$)
$\delta^{13}\text{C}_{(\text{en})}$.153
$\delta^{18}\text{O}_{(\text{en})}$.077

Table 10-14: A Comparison of the Tiriş Human Collagen $\delta^{15}\text{N}$ Values and the $\delta^{15}\text{N}$ Values for Ovicaprids Reported by Trella (cf. 2010, *unpublished dissertation*: Table 9.1).

Period	Tiriş Human Bone Mean $\delta^{15}\text{N}_{(\text{coll})}$ (This study)	Tiriş Ovicaprid Bone Mean $\delta^{15}\text{N}_{(\text{coll})}$ (Trella 2010: Table 9.1)
Early EBA	+7.7‰	+7.3‰
Mid EBA	N/A	+5.5‰
Late EBA	+7.4‰	+5.2‰

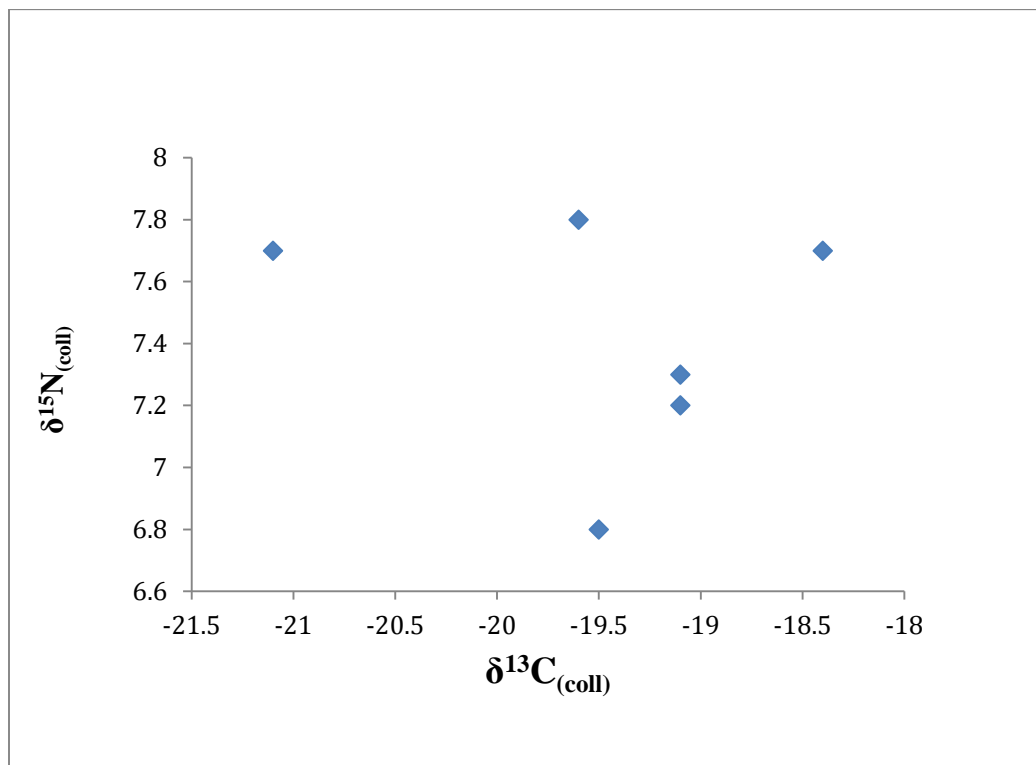


Figure 10-1: Scatterplot of the $\delta^{13}\text{C}_{(\text{coll})}$ and $\delta^{15}\text{N}_{(\text{coll})}$ values from the Titriş Höyük human collagen samples.

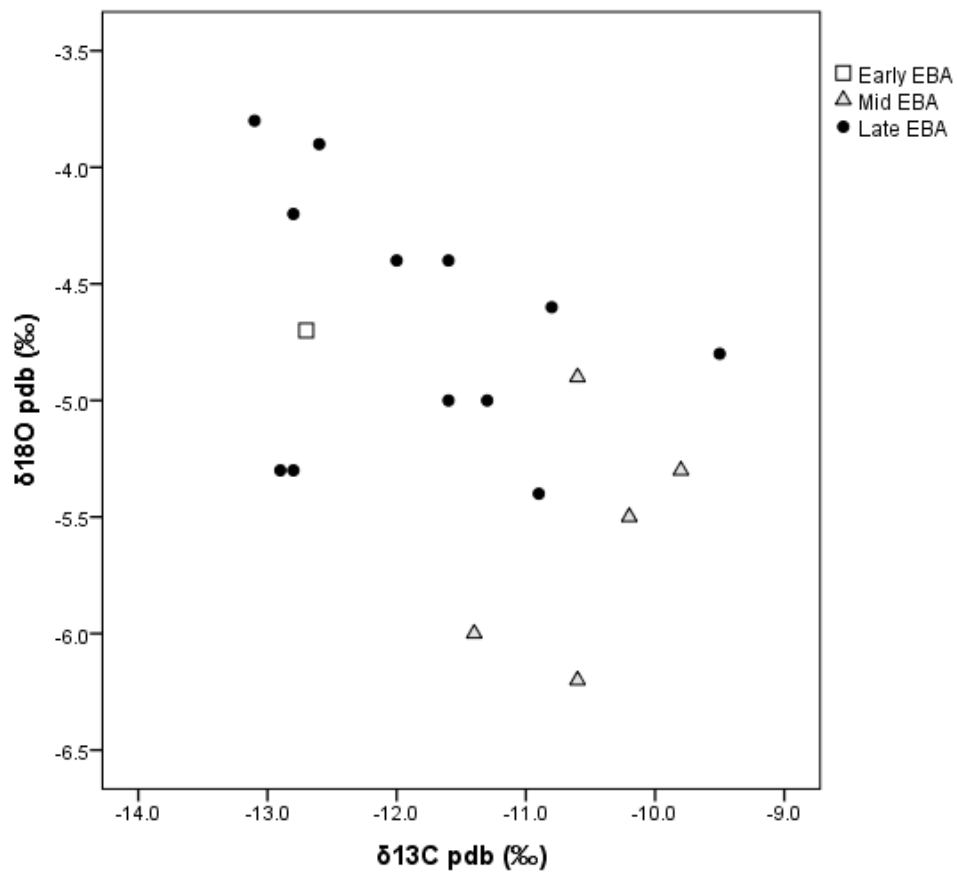


Figure 10-2: Scatterplot of the $\delta^{13}\text{C}_{(\text{apa})}$ and $\delta^{18}\text{O}_{(\text{apa})}$ values from the Titriş Höyük human bone carbonate samples.

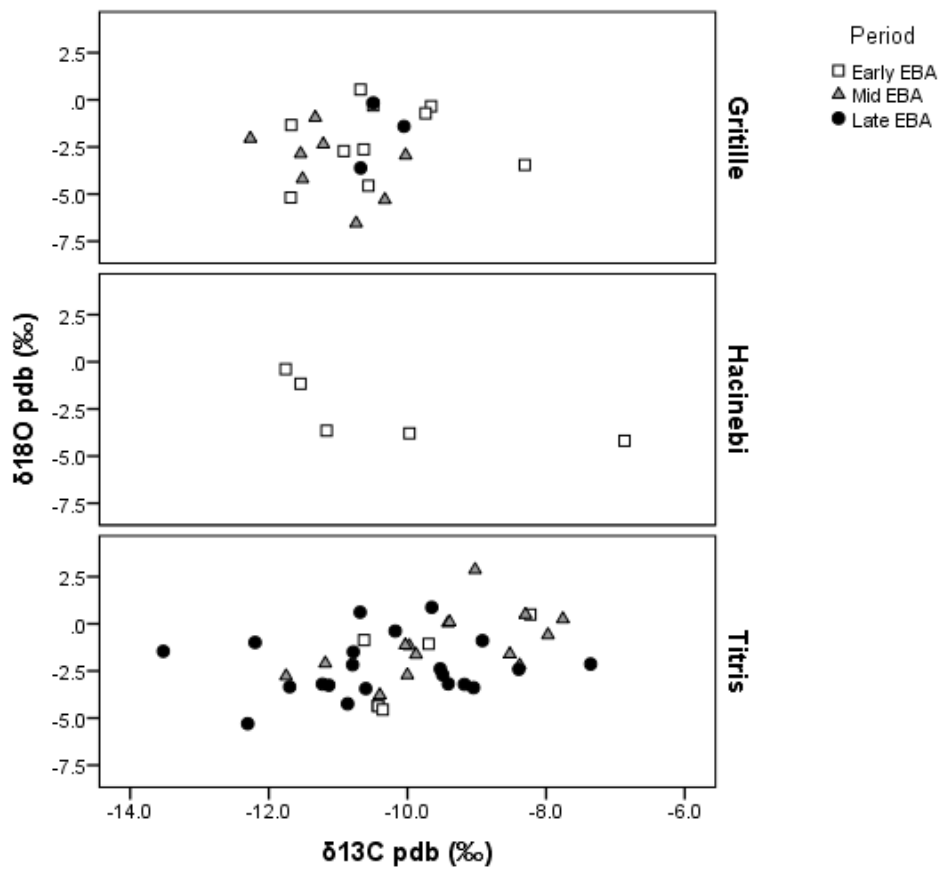


Figure 10-3: Scatterplots of $\delta^{13}\text{C}_{(\text{en})}$ and $\delta^{18}\text{O}_{(\text{en})}$ values from Titriş Höyük, Gritille Höyük, and Hacinebi.

Chapter 11: The “Perfect Storm”: A New Multicausal Scenario for the Political Collapse of Titriş Höyük

When combined with other archaeological and historical evidence, the results of the stable isotope analysis of human and faunal skeletal remains from the Karababa Basin I have conducted in this study enable a new understanding of the circumstances surrounding the political collapse of Titriş Höyük during the Late EBA. Using these results and the other archaeological, historical, and paleoclimatic evidence discussed in Chapters 4-9, I will present here a new multicausal model for this event. This model follows the framework pioneered by Sewell, which emphasizes not one but several causal factors. My new multicausal explanation will then be compared to the 4.2 ka hypothesis, in order to assess the similarities and differences between these two explanations. Finally, I will close by discussing some of the most important unanswered questions that remain to be resolved, and some possible directions for future research that may help to further illuminate our understanding of what happened in the Karababa Basin a little over 4000 years ago.

11.1: The Collapse of Titriş Höyük as a Sewellian Event

At the close of Chapter 2, I argued that the Sewellian “event-based” approach to the study of individual collapse events has the potential to serve as an effective theoretical framework for the archaeological study of collapse. I will now attempt to put this argument into practice, as the multicausal explanatory model for the political

disintegration of Titriş Höyük presented here has been consciously developed within this framework.

Let us first consider whether the collapse of Titriş Höyük qualifies as a historical event in the Sewellian sense. The first requirement of a Sewellian event is that there must be multiple factors involved. In the Titriş Höyük collapse model I am about to describe, there are at least four mutually interrelated causal factors that may have influenced the events which led up to the collapse of Titriş Höyük at some time between 2250-2150 BC (listed in no particular order):

- Late 3rd millennium climate change (possibly caused by the 4.2 ka BP event)
- The destabilization of the regional economic and political status quo in northern Mesopotamia partly as a result of the destruction of Ebla in c. 2350 BC
- The collapse of established long-distance exchange networks in which Titriş Höyük, by virtue of its control over the Samsat ford, was a participant
- The emergence during the Late EBA of competing powers that dominated alternate routes or fords across the Euphrates, such as Carchemish

The second major component of a Sewellian event is that it must involve factors that have different temporalities. This is certainly so in the case of the four causal factors outlined above. The regional destabilization of the established Mid EBA status quo of northern Mesopotamia actually occurred in two stages: the old order began to break down with the arrival of the Akkadians in c. 2350 BC, but then stabilized for a century or so before the process of regional disintegration accelerated dramatically after 2200 BC. The long-distance exchange system in the Eastern Mediterranean, on the other hand, actually reached its peak of activity in c. 2300 BC, but then rapidly declined; by 2200 BC, it had effectively collapsed (cf. Broodbank 2013: 350). The rise of Carchemish, based on its advantageous location at a known historical ford of the Euphrates, which would result in its becoming the pre-eminent city-state in the Lower Turkish Euphrates Valley during the Middle Bronze Age, began at approximately 2200 BC, if not slightly afterwards (cf. Wilkinson 2007: 37-38). It is not yet possible to say with precision when drier conditions took hold in the Karababa; however, to judge from 1- σ date ranges for the Late EBA AMS ^{14}C determinants that were derived from human bone collagen samples in this study, it is clear that the increase in aridity occurred at some time prior to 2200 BC.

Finally, a Sewellian event must also result in a durable transformation of social structures. It is clear from the archaeological evidence that the disintegration of Tiritiş Höyük did indeed result in a major transformation. For one thing, the city itself was virtually abandoned by the end of the millennium, never to become a major urban center again. The reorientation of the Karababa during the Middle Bronze Age, with

the emergence of Lidar Höyük and Samsat Höyük as the largest urban centers in the basin, constitutes a further structural change. Moreover, at a broader level, the collapse of Tiriş and the contemporaneous rise of Carchemish also resulted in a reorientation of long-distance commerce in the Euphrates Valley as a whole – while the Karababa Basin had been the central hub of overland east-west trade during the Middle EBA, by the Middle Bronze Age Carchemish was engaging in extensive trade with Mari and the Mesopotamian alluvium via the Euphrates River, and became the fulcrum east-west overland trade across the southernmost reaches of Upper Mesopotamia.

As the discussion above clearly demonstrates, the political collapse of Tiriş Höyük does indeed fulfill Sewell's criteria for a historical event. I will therefore apply the Sewellian framework to the study of the disintegration of this polity and its hegemonic structure of control over the Karababa Basin. The model that is proposed below will, I hope, serve as an instructive example of the utility of Sewell's event-based perspective for Near Eastern archaeology – even in cases, like that of Tiriş Höyük, in which there is no local historical record upon which to draw.

11.2: A Multicausal Explanation for the Collapse of Tiriş Höyük

I will now turn to describe the multicausal model itself. As the title of this chapter suggests, the basis of this scenario is a confluence of separate events and processes that, because they occurred in a specific sequence, resulted in the political disintegration of Tiriş Höyük. As I am arguing that the collapse of Tiriş Höyük was

a contingent (i.e., Sewellian) historical event, particular emphasis will therefore be placed on conceptualizing how the four factors described above acted in concert, as it were, by considering how they together might have impacted the city's economic viability and sociopolitical stability.

11.2.1: Late EBA economic decline at Tıtrıř Hyk.

11.2.1.1: Reduced agricultural productivity. As I explained in the previous chapter (see Section 10.4.2), the most plausible paleoclimatic interpretation of the stable isotope evidence obtained in this study is that there was a climatic shift towards markedly (though not cataclysmically) drier conditions during the late 3rd millennium BC. Given that the Karababa Basin is situated in an area that is both dry and exhibits particularly high rainfall variability (as I discussed in Chapter 3.1), this change would probably have manifested as both an overall reduction in annual precipitation levels and a concurrent increase in the interannual variability of precipitation. Indeed, the results of geomorphological investigations at Tıtrıř Hyk suggest that increased drought and unstable precipitation patterns during the late 3rd millennium may have resulted in increased erosion and strong flooding events, particularly in the Tıtrıř ay as it slowly ceased to flow perennially (cf. Rosen and Goldberg in Algaze *et al.*, 1995: 36-37).

If Tıtrıř Hyk did indeed experience such a climatic transition during the Late EBA, as the isotope data from the human bone carbonate suggests, it is very likely that this would have seriously disrupted the city's subsistence economy. As Slater has noted, "[l]arge-scale, non-irrigated monoculture [. . .] is especially vulnerable to

climate anomalies” (1981: 27). While Titriş Höyük’s heavy reliance upon dry farming of cereal crops cannot quite be considered “large-scale” or “monoculture”, the rain-fed subsistence farming practices employed by the city and its agricultural hinterland satellites would still have most probably left it in a similarly disadvantaged position in the event of a shift toward drier conditions.

While the most profound effect of such a change would likely have been a reduction in cereal crop yields (as discussed in Section 10.4), other sectors of the agricultural economy of Titriş Höyük and its subsidiary urban centers may also have suffered as a result. Drought could, for example, have been detrimental to the region’s viticulture industry (see Section 6.3.1), thus affecting the production of potentially valuable export products like wine, grapes, or raisins (see Section 4.2.1).

On the other hand, there is no reason to believe that these drier conditions would have significantly impacted the pastoral economy. On the contrary, the isotope data presented in Chapter 10 suggest that the pastoral economy was relatively unaffected by climate change. Consequently, this agricultural sector may have become thus more important during the Late EBA than it had been during the previous period. Thus, as I will discuss below, this development may also have had unforeseen social and political consequences.

In the short term, the city could potentially have attempted to make up for its grain harvest “budget deficit” by increasing its tributary demands on secondary centers and hinterland. However, if agricultural productivity did not quickly return to its previous level, it is difficult to see how such a one-sided arrangement could have been

a sustainable means of providing the city with adequate supplies of food. The increased pressure upon secondary centers and the rural hinterland to supplement the reduced agricultural output of Titriş with their own food reserves would surely have created problems of local supply for those other communities, given the much larger population of Titriş. Moreover, it is also likely that the drier conditions in the basin would have reduced the agricultural productivity of these other centers as well, meaning that they would have fewer surpluses to extract as tribute. It is likely, as I will discuss further below, that increased demands for agricultural produce from the central authorities would over the long run have led to increased resistance, and possibly even rebellion in these hard-pressed outlying communities.

Another option would have been to acquire additional reserves of food via trade with other polities, such as Kazane Höyük in the nearby Harran plain. During the Early Bronze Age, it was by no means unknown for cities to supply each other with foodstuffs via trade. However, Titriş Höyük's bargaining position would have been weak under these circumstances, and potential trading partners would have been able to set very high prices – or to demand other political concessions from the city – in exchange for granting access to their surpluses.

Ironically, the onset of drier conditions during the Late EBA could very easily have provided a disincentive for the community to attempt to adapt to changing environmental circumstances at all. In many pre-industrial societies, adaptation to environmental change resulted in “a pull toward conformity rather than change, and intensified discrimination against those members of society who do not conform”

(Rosen 1995: 40). Any attempts to resolve new problems with innovative practices, including changes in agricultural practice, would therefore very likely have faced substantial opposition, particularly from the ideological authorities. This would likely have made it more difficult for the city's leaders to make substantive changes in economic or political policy that would have upset the established status quo, such as adjusting the production quotas, even if those new policies would potentially have been beneficial in the face of changing environmental conditions.

If the city authorities failed to maintain the expected levels of agricultural output, this would have negatively impacted the city's economy. To reiterate what I argued earlier concerning the nature of the Tiriş economy (see Section 6.3), it is highly likely that this was organized into a state-run system of redistribution. Accordingly, a permanent reduction of agricultural yields, brought on by the onset of drier conditions in the vicinity during the Late EBA, would likely have resulted in a sudden recalibration of the value of labor and the prices of goods and services, as these were paid for either in grain, or in other goods whose value was based on that of grain.

In that event, determining where to cut back on grain ration levels would have constituted a particularly acute problem for the city authorities. In addition to creating economic problems, sustained crop shortages likely also would have undermined the social cohesion of the polity. Given that early Mesopotamian states partly derived their political power from their redistribution of food and other essential resources to the population, this could also have resulted in a loss of legitimacy for the city's rulers.

Additionally, shortages might also have increased friction between social classes. Throughout northern Mesopotamia, elite lineages received preferential access to food and other goods as befit their status. With a reduced overall surplus to distribute, balancing the demands of these aristocratic members of society with the needs of the laborers would, in all probability, have been a delicate task even in the best of circumstances. On the one hand, reducing the elites' unequally large share of the state produce would most probably have resulted in a loss of support among the nobility for the rulers of Titriş Höyük; on the other, maintaining the status quo for the elite classes while cutting grain-based "wages" for the commoners would instead have created mass discontent and undermined the legitimacy of the state in the eyes of the majority of its subjects.

Moreover, the reduced productivity of cereal crop agriculture at Titriş Höyük and subsequent loss of rations could also conceivably have attracted some (perhaps even many) of the city's agricultural laborers to abandon settled urban life for the relatively stable lifestyle of the pastoralist communities. As I have argued already (see Section 10.4.3), the stable carbon and oxygen isotope evidence obtained in this study suggests that mobile pastoralists and their flocks were able to adapt more readily to changed environmental conditions than the settled farmers of Titriş. It is therefore easy to imagine that many of the unskilled agricultural laborers employed by Titriş Höyük, who were largely or entirely dependent on the redistribution of agricultural surpluses by the city authorities for their subsistence, might have found a relatively

independent, mobile pastoralist lifestyle an attractive alternative to their changed situations.

In that event, the city's cereal crop agricultural productivity would likely have suffered further. As the pool of available agricultural labor thus was depleted by a shift to pastoralism, maintaining the previous levels of agricultural output would have become increasingly more difficult. It is therefore possible that this created a vicious cycle, with more and more laborers being drained away from the city and its immediate agricultural hinterland to instead roam the surrounding countryside with animal herds. It is difficult to see how, without a large and stable base of agricultural laborers, the city would have been able to sustain itself economically for long, particularly in drier-than-average years, when the climate would have been particularly unfavorable for cereal crop agriculture.

11.2.1.2: The loss of trade and its impacts on the Tiritiṣ production

economy. The loss of the viability of the agricultural economy of Tiritiṣ, in turn, would have been compounded by changes in regional trade patterns. As I explained in Chapter 5, it is already well established that Early Bronze Age networks of long-distance commercial interaction provided many communities with access to valuable commodities and new technologies, and also helped to consolidate and legitimate the authority of emerging sociopolitical elites. But as long-distance interaction and exchange became increasingly integrated into the social, economic, and even ideological fabric of many participating polities, these societies would likely have become more susceptible to serious social and economic shocks when these networks

eventually broke down in c. 2250 BC. Thus, although it is not typically given much thought as a causal factor of the regional decline of Early Bronze Age complex societies at the end of the 3rd millennium BC (except, perhaps, for Butzer 1997), there are indications that long-distance interaction and trade may have played an indirect role in exacerbating the spread of crisis not only in northern Mesopotamia, but across much of the Eastern Mediterranean.

Although difficult to quantify, it seems intuitively clear that many of the sudden cultural transformations that occurred during the latter phases of the Late EBA that are visible in northern Mesopotamia and northwestern Syria are temporally correlated with the waxing and waning of long-distance exchange networks. The system of international interaction and exchange that had flourished during the middle centuries of the millennium seem to have collapsed during its final quarter. In the case of Tiriş Höyük, the fairly close temporal correlation of the disintegration of the Anatolian Trade Network in approximately 2200 BC (Şahoğlu 2011: 177), which linked Tiriş to polities in Western Anatolia and the Aegean, with the political collapse of the city-state of Tiriş itself may not be a coincidence.

Given the peer-to-peer nature of the long-distance exchange system, it is impossible to describe the decline of the Tiriş Höyük production economy without also referring to other developments taking place across northern Mesopotamia and the Aegean Basin at this time. As was discussed in Chapter 4, the Late EBA was a period of marked disruption for the majority of urban centers in the region, and the

pattern of events that accompanied the decline of polities in many parts of Upper Mesopotamia is rather similar.

During the Mid EBA cultural florescence of the north, the largest and most important cities in the region were mostly located in the Upper Khabur Basin of northeastern Syria. This area was also hit particularly hard during the final two centuries of the millennium; only a few of its urban centers – notably Tell Brak and Tell Mozan – survived more or less intact. By the end of the Early Bronze Age, the vast majority of the Upper Khabur's cities were either drastically reduced in size and population, or were simply abandoned (see the discussion in Section 4.1.3).

It is likely that, despite the distance between them, the political collapse and abandonment of many of the major cities of the Balikh and the Upper Khabur between 2200-2100 BC may have been a particularly serious blow to the Tigris trading economy. For one thing, it has been suggested that these regions were linked directly with the Karababa via overland east-west trade routes (as was discussed in Section 6.4). This notion is supported by evidence of metallic ware imports, widely distributed across Upper Mesopotamia, that have been found at Gritille Höyük (see Section 6.4.1). Moreover, the Upper Khabur seems to have been a major hub of trade with the Upper Tigris Valley and the Mesopotamian alluvium. Thus, the indirect commercial ties with these region, which are suggested, albeit rather tenuously, by a few chance finds from looted Tigris tombs (see Section 6.4.1) would have also severed. Given that the east-west overland trade was probably one of the primary strategic advantages of the location of Tigris Höyük, it follows that the collapse of the

Upper Khabur – notwithstanding the fact that a few polities in this area, such as Tell Brak and Tell Mozan, appear to have survived this period intact – would likely have resulted in a considerable reduction in the importance of the city to what was left of the regional trading economy.

By the same token, the abandonment of other urban centers trading with Tiriş Höyük that lay between the Karababa and Khabur along those overland trade routes, such as Tell Chuera, probably also hurt the trade economy of Tiriş. It is important to again stress that Early Bronze Age long-distance trade networks were indirect, peer-to-peer affairs. Thus, the destruction of Tell Chuera, which is strategically located between the Karababa and the wealthy cities of the Eastern Khabur, could also have caused a considerable disruption to east-west overland trade.

While the chaos in the Khabur and the Balikh would have disrupted trade contacts via the east-west overland route during the Late EBA, riverine trade with polities in the Upper Syrian Euphrates Valley was also probably disrupted by political events taking place during this same period in northwestern Syria. Ceramic parallels suggest that a number of urban centers in this region possibly had trading relationships with the Karababa Basin, such as Tell es-Sweyhat; these were violently destroyed during the Late EBA. Of particular political and economic importance was the sacking of the powerful city-state of Ebla, ostensibly by the Akkadians, at some point prior to 2200 BC. Because the textual record suggests that Ebla was the dominant polity in this region, its destruction seems to have shattered the prevailing economic and political status quo in the region. For example, in the wake of the city's

destruction, some of the other cities that had previously been under its sway, such as Carchemish, were apparently able to thereafter establish their independence (Wilkinson 2007: 38). Thus, with Eblaite control over this area broken, the structure of existing economic as well as political relationships that had developed during the Mid EBA became fluid, as new trading markets opened while established ones closed amidst the chaos and violence that seems to have swept through the region during the Late EBA.

These events, along with the disintegration of the Anatolian Trade Network, would almost certainly have significantly disrupted the export economy of Titriş Höyük, and would thus likely have imposed further economic hardships upon the city. Given that its position along important lines of east-west communication across the Euphrates was probably Titriş' *raison d'être*, the economic and social fallout from the loss of trade along these routes as political and economic conditions changed would likely have been severe. Not only would such an event have disrupted the city's ability to obtain goods from abroad (which I will discuss in depth in Section 11.2.2 below), but those facets of the local production economy which were probably meant for export as well as local consumption, such as the local viticulture industry (see Section 6.3.1), would also have been impacted by a loss of export markets for those products. It is likely that, at a single stroke, craft specialists and others whose occupations were geared towards participating in and facilitating transregional trade networks – including the administrators needed to manage and regulate economic interactions – would have discovered that their services quickly became redundant

once the export market began to dry up. This would have left those skilled artisans and officials with little choice but to leave the settlement in the hopes of plying their trade somewhere else – such as the city of Carchemish, whose star was ascending at this time (see Section 11.2.3 below).

11.2.2: Late EBA social and political destabilization at Tiriş Höyük.

11.2.2.1: Increased social tensions between groups. Although we cannot say precisely who was involved, osteological evidence does appear to indicate that violent infighting began to increase within the community during the city's Late EBA decline. Paleopathological investigations have revealed a generally increased incidence of skeletal lesions consistent with trauma during the Late EBA, which constitutes evidence of increased interpersonal violence at Tiriş in comparison with earlier periods (cf. Erdal and Erdal 2012: 82). In particular, the massacred individuals from the plaster basin burial (see Section 6.1.3) provide a grisly and instructive indication of this trend.

If tensions were indeed running high among residents of the city – and it must be said that the meager available evidence is certainly not sufficient to draw any firm conclusions on that score – then this could be conceivably attributed to increased stress between social groups that was indirectly driven by reduced agricultural productivity, or violence may have been fostered by increased regional competition, or more likely both. The link between food shortages and heightened tensions between social classes is a persistent thread that runs through human history. For example, a parallel scenario may have played out in the Upper Tigris Valley during the mid-7th

century BC, where a severe drought coupled with urban overpopulation potentially fueled unrest and helped to stoke a civil war that nearly brought the Neo-Assyrian Empire to its knees (cf. Schneider and Adalı 2014). Moreover, the role of food shortages as an instigator of sociopolitical crisis can also be observed in multiple more recent historical cases. Cases in point include late 1780s France (e.g, Schama 1989: 434) and Tsarist Russia during the winter of 1916-1917 (e.g., Figs 1996: 298-300). These historical examples add further support to the idea that crop shortages would probably also have led to increased social friction along class lines at sites such as Titiş.

Another potential social flashpoint could have involved interaction between Titiş Höyük's settled agriculturalist and nomadic/semi-nomadic pastoralist groups. It is generally assumed that the former were the dominant social and political group in Early Bronze Age northern Mesopotamia. However, if, as I suggested above, the role of animal secondary products such as dairy, hair for textile manufacture, and the like did assume increased importance during the Late EBA, then this may have helped increase the economic and political position of the city-state's pastoralist groups at the expense of existing elites. So too might the increase of the nomadic pastoralist populations if they were indeed being supplemented with disaffected agricultural laborers from the cities. If and how these groups might have sought to transmute this situation to their political advantage is impossible to say from the available archaeological evidence. But it is certainly conceivable that the relatively strong position of the pastoralist

element could have further undermined the structure of the prevailing social hierarchy that was established during the city's Mid EBA apogee.

11.2.2.2: The loss of political legitimacy. In addition to its economic and social consequences, by causing a reduction in crop yields, climate change may also have indirectly contributed to a breakdown of prevailing ideological systems at Titriş Höyük. As Rosen notes, “the responses to natural crises are defined by the logical framework of a society's cosmology” (1995: 39). Given that the Early Bronze Age view of the ruler as a cosmological bridge between the earthly realm and the gods, the onset of climatic conditions unfavorable for agriculture – and, just as importantly, the perceived inability of the ruler to successfully intercede with the gods to rectify the problem – would likely have been seen as an indication of divine punishment or disfavor. This was certainly the case in southern Mesopotamia, where the gods were seen as responsible for both natural and historical events, and therefore climate change would have been seen as a sign of divine disfavor (cf. Jacobsen 1976). If the same was true for Titriş Höyük, it is not difficult to see how the onset of drier conditions in the region could have fueled dissatisfaction with the leadership of the city, and potentially caused a serious loss of public confidence in the legitimacy of the political order.

In addition, given that the acquisition of prestige goods and other key imports formed part of the foundation of Early Bronze Age social hierarchies, it is probable that a loss of access to these socially important items helped to undermine the exalted position of elites, and by extension, the legitimacy of the prevailing hierarchical social

system. We must also not forget that the feasting and drinking ceremonies, which were apparently so central in Early Bronze Age civic life, were imbued with symbolic or religious significance – as were the metal or ceramic (particularly imitation metal) vessels associated with them. The symbolic importance of banquets is clearly demonstrated in Early Bronze Age Mesopotamian iconography, and the textual evidence which places commensal feasting and drinking within the context of important religious or social rituals (as was discussed in Chapter 5). In this sense, then, it is a very real possibility that once international exchange networks had ceased to function properly, the failure of local elites at Tiriş Höyük to obtain socially and/or ideologically important luxuries could have resulted in a sudden loss of public confidence in the elite management of the polity.

The collapse of the political status quo during the Late EBA appears to have led to an upsurge in violence and warfare throughout northern Mesopotamia (and vice versa). The establishment of defensive fortifications at Tiriş Höyük, and the finding of victims of an apparent massacre found in the plaster basin burial in the city's Outer Town not far from the new defensive wall, suggests that the Karababa Basin was perhaps also swept up in the violence of the times. However, thus far in the handful of excavated Karababa sites we have no evidence of settlements being razed or sacked, as was the case to the south. It is therefore probable that the Karababa was too peripheral, both geographically and politically, to merit much attention from the outside. This does not mean, however, that the region experienced no internal conflict; as I discussed in Chapter 6, it has been suggested that the reorientation of the

agricultural hinterland of Tiriş was connected to the outbreak of hostilities with the smaller city-state of Tatar Höyük, which may have been an erstwhile secondary center of Tiriş during the latter's Mid EBA apogee.

Reduced cereal crop yields, the inability to obtain exotic commodities that were socially or ideologically significant, and increased violence both in the Karababa Basin and across the wider northern Mesopotamia region, would each have contributed to the political destabilization of Tiriş Höyük as a state-level society. Given what we know about the sociopolitical structures of Early Bronze Age urban centers in the Mesopotamian culture area, it is likely that the combination of the three would severely undermined the foundations of Tiriş Höyük as a hierarchical, state-level social system. As was discussed in Section 4.3.3, the primary role of Early Bronze Age rulers in Mesopotamia were to intercede with the gods to protect the community against natural disasters such as droughts, floods, or plagues, or man-made ones like raids or invasions launched by neighboring polities. In the face of the various forces acting upon the city-state, it seems unlikely that the rulers of Tiriş Höyük would have been able to successfully fulfill the social expectations incumbent with their office, especially over the long term. As a result, it is also likely that the institution of kingship also gradually lost its authority as the various problems affecting the city began to mount. Under these conditions, climatic deterioration and its impacts on the subsistence economy of Tiriş may have been the final straw that broke the camel's back.

Once this highest political office – the linchpin of virtually all archaic states – had lost its legitimacy, the state would have been left with few ways to maintain its control save the direct application of brute force to ensure compliance with its directives, and even that solution would have been expensive and in any case unlikely to have been successful in the long run. It seems likely, then, that once the institution of kingship had completely lost its perceived legitimacy, and thus its capacity to make the population obey without needing to continually resort to physical coercion, the administrative organs of the state would probably have ceased to function effectively in short order. This failure would thus have resulted in the final collapse of the whole political system of Titiş Höyük, which could no longer effectively govern itself.

11.2.3: How the rise of Carchemish may have contributed to the decline of Titiş Höyük. The economic and social, and political problems described above would thus have considerably weakened Titiş Höyük, and probably resulted in the political failure of that city-state. But to fully understand why it collapsed – and, just as importantly, why it did not recover during the Middle Bronze Age like some other cities did – we must turn our attention downstream along the Turkish Euphrates to the Birecik-Carchemish Corridor. For at approximately the same time that Titiş Höyük began its decline, a viable economic competitor controlling an alternate cross-Euphrates trade route emerged in this area: the city-state of Carchemish. This polity, which was apparently economically insignificant and politically peripheral during the Mid EBA, rose to achieve a position of considerable importance during the Late EBA (Wilkinson 2007: 37-38). By the beginning of the Middle Bronze Age,

Carchemish appears to have become the dominant economic force in the Upper Syrian Euphrates Valley, and was heavily involved in riverine trade down the Euphrates, notably with the Kingdom of Mari (*ibid*: 38), and also involved in trade to the west of the Euphrates with polities in the Syrian Saddle.

A likely explanation for why Carchemish was able to expand rather than contract during the Late EBA is that the site was situated in a floodplain along the Euphrates where irrigation agriculture was more feasible (Wilkinson 2007: 31-34). As a result, the city was probably more drought resilient than nearby polities – including Tiriş – that were primarily reliant upon rain-fed agriculture for their subsistence. Consequently, Carchemish was in a position to soak up waves of refugees from a variety of other polities across Upper Mesopotamia that were struggling to support their agglomerated urban populations. It is therefore quite possible that many of the agricultural laborers from Tiriş Höyük and other, smaller Karababa urban centers migrated to Carchemish and other still viable urban settlements such as Tell Bi'a and its hinterland, which in turn would have allowed them to expand their agricultural catchment areas.

Whatever the reason for its growth, the obvious appeal of relocating to a relatively wealthy, stable city like Carchemish may also have caused struggling settlements like Tiriş Höyük to experience a “brain drain” of their specialist craftsmen, scribes, and officials. For example, because Carchemish was well placed to conduct trade with downriver polities along the Euphrates, and seems to have avoided the decline experienced by many of its neighbors, the city, although

located relatively far away from the Karababa Basin, could have been an attractive place for artisans with highly-prized skillsets like bronze-working. (It is also conceivable, although there is no evidence to suggest it, that Carchemish, hoping to take advantage of the weakness of other struggling city-states, may have encouraged this.) Whatever the reasons for it, over time this process would likely have developed into a positive feedback loop: as the loss of these specialists caused the local production economies of Titriş Höyük and other struggling cities to shrink, or affected their political stability, further waves of specialists seeking better opportunities would also become more likely to leave for Carchemish, and so on.

There are numerous historical parallels for this process. For example, during the 13th and 14th centuries AD, a number of important scholars and artisans were enticed away from Muslim-held lands in Spain (al-Andalus) to Almohad-ruled Morocco, which was, if only briefly, a far more politically and economically stable environment than the rapidly declining mini-states of al-Andalus (cf. Pennell 2003: 54-58). More recently, the collapse of the Soviet Union and its Warsaw Pact bloc has resulted in a protracted “brain drain” over the course of the following decades, which involved both the emigration of important specialists abroad and the shift of others who had served the state previously to work instead for private industries, many of which were also foreign-owned (cf. Moody 1996).

11.2.4: Summoning up a “Perfect Storm”: a multicausal model for the collapse of Titriş Höyük. Having now explained the various impacts of the four primary causal factors outlined here upon the economic, social, and political stability

of Late EBA Titriş Höyük, it is now possible to weave them together into a single, coherent scenario. It bears pointing out that some elements of this model are based in substantial part upon informed speculation or historical analogies. However, this model is nonetheless based primarily upon the archaeological, historical, and paleoclimatic proxy evidence discussed in the previous chapters of this dissertation.

It is likely that the process leading up to the decline of Titriş Höyük began with the shakeup of the established regional system of economic and political relationships that had developed in northern Mesopotamia during the Mid EBA. The intrusion of the Akkadians into the region – particularly the Upper Khabur – was probably at least partly responsible for this, although as was discussed in Chapter 4, the precise nature and extent of their involvement in Upper Mesopotamia remains unclear. It is possible that for a while, a new status quo may have been established as the cities of the region adapted to the presence of their powerful southern neighbor. However, by 2200 BC, if not earlier, the reorientation of power relationships in northern Mesopotamia began in earnest.

Another critical causal factor was the collapse of long-distance trade networks that had evolved during the course of the Mid EBA. This system, or at least large portions of it, appears to have broken down completely by approximately 2200 BC. It is difficult to exaggerate the probable importance of this development. Indeed, for Titriş Höyük, whose primary strategic advantage was its position as a hub for several trade networks that linked it not only with the cities of Syria, but also more distant trade partners in Anatolia, the Aegean, and the Caucasus, the disintegration of region

trade would likely have been little short of disastrous. This would have been especially true for the city's elites. Not only would they have lost access to exotic luxuries that helped to reify their exalted social standing, but because many of these objects probably had ideological as well as social meaning, the inability to obtain objects that were associated with important ceremonies would have undermined the ideological basis for the legitimacy of the sociopolitical order.

As the results of the stable carbon and oxygen isotope analysis conducted in this study appear to demonstrate, at some point during the Late EBA climatic conditions in the Karababa Basin became drier, and thus less favorable for agriculture. It is not clear whether this change in local climate is an expression of the severe, prolonged regional drought that is a fixture of the 4.2 ka hypothesis, or of a less intense climatic perturbation. But in any event, it is likely that the local climatic shift reflected in the isotope data did decrease crop yields, and especially the productivity of cereal crop agriculture.

It seems likely that the reduced agricultural output of Tiritiř would have left the city's authorities with fewer and fewer options to supplement the reduced grain supply, particularly over the longer term. The "simplest" solution for them to enact would be to extract larger and larger agricultural tributes from secondary centers and the rural hinterland to help make up the difference, but this measure would likely have provoked resistance from these peripheral communities. And in any case, because the agricultural output of these smaller centers was probably also reduced by climate change, it is unlikely that this strategy would have been a very effective means of

dealing with the problem. Another option would be to try and acquire food reserves by trade, but this would have placed the city at a considerable disadvantage with other polities that could have exploited Tiriş' problems for their own benefit.

Although the archaeological record gives us very few clues from which to make inferences about how these various factors may have undermined the stability of Late EBA Tiriş Höyük, there are a few hints scattered through the evidence that can be employed to construct a hypothetical scenario for the political disintegration of the city-state. Given both the stable isotope evidence for reduced agricultural productivity and paleopathological evidence for increased interpersonal violence, it is reasonable to suppose that the weakness of the city's Late EBA subsistence economy may have helped to open up or amplify dormant tensions within the community. Among elite lineages, squabbles about status would likely have taken on a new importance in the face of reduced access to a variety of important commodities – particularly those that had to be obtained via long-distance trade. Reduced crop yields would also probably have required the city authorities to cut back on labor rations, which would have undoubtedly caused resentment among those who had suddenly lost a portion of their subsistence. Pastoralists groups potentially also saw their positions strengthened at the expense of the city's settled farmers.

Assuming that social friction did increase in Late EBA Tiriş Höyük, this would likely have placed increased pressure upon the city's political authorities. Because the nature of kingship in the archaic states of Mesopotamia (see Chapter 4) was based largely on the role of the ruler as an interlocutor between the city and the

gods, the ideological basis for the authority of those in power would likely have been seriously undermined in the face of the inability of the ruler to reverse the process of climatic deterioration. All told, it is very likely that a reduced agricultural capacity, which was caused at least in part by climate change, would have weakened the standing of Titriş Höyük's rulers considerably, and thus helped to bring about the collapse of its centralized political institutions.

Faced as they likely were with a combination of lower food levels, economic decline, and increasing sociopolitical instability, it is very likely that many of the city's urban residents simply left the polity as their hardships began to mount. Many, notably unskilled agricultural laborers, may have been enticed by the prospect of the independent, migratory lifestyle practiced by nomadic pastoralist communities, which was more resilient in the face of the drier climatic conditions that appear to have taken hold during the Late EBA. Others, particularly those with specialized skills that were particularly valuable within an urban setting, may have gone to other cities that were more stable.

Finally, because the troubles experienced by Titriş Höyük were happening at approximately the same time as Carchemish began to emerge as an independent and increasingly important city-state in northwestern Syria, the economic fortunes of the two polities were likely (albeit indirectly) intertwined to some extent. For one thing, when the east-west overland trade dried up as the Upper Khabur and Balikh polities began to disintegrate, Carchemish, which was situated further downriver from Titriş, held a much more advantageous position to benefit from riverine trade along the

Euphrates, as its location would have allowed it to interpose itself as a middleman for any trade between the Karababa and the rest of Syria and Mesopotamia. Given the importance of trade to the economy of Titriş Höyük, it seems probable that this would have contributed further to the economic decline of the city, and indeed, of the Karababa Basin as a whole.

At some point, the combination of these various pressures caused Titriş to reach a breaking point – the point when the city ceased to be a viable political unit. We cannot say with certainty exactly when the decline of Titriş reached this “tipping point,” as Sewell would call it. However, because this study was able to procure a more refined AMS ¹⁴C chronology for the Late EBA period (see Chapter 3), it now appears that a reasonable *terminus ante quem* for the complete abandonment of the Lower and Outer Town – and thus, the cessation of Titriş Höyük as an urban center – is 2150 BC. If, the depopulation of much of the the Khabur took place between 2200 and 2100 BC, as Weiss and others have argued (e.g., Weiss *et al.*, 1993; Staubwasser and Weiss 2006), then given the probable economic impacts of this contraction in the Khabur, it seems likely that the decline of Titriş also began to accelerate during that span.

In sum, although it is not yet possible to conclusively date the decline of Titriş Höyük, the currently available evidence suggests that this process probably occurred in two stages. The first stage was the reorientation of the site and its hinterland, as was discussed in Section 6.1, which probably occurred between 2400-2300 BC, and was likely tied to other political developments in the region, such as the Akkadian

intrusion and the sacking of Ebla by Sargon the Great. The second stage of this process was the deterioration of the polity, which likely began in 2200 BC and quickly accelerated; to judge from the available Late EBA AMS radiocarbon dates, by 2150 BC, the political disintegration of Tiriş Höyük and the abandonment of most of the settlement was probably complete.

11.3: Comparing This Model with the 4.2 KA Hypothesis

At first glance, this scenario looks remarkably similar to the 4.2 ka hypothesis first proposed in 1993 by Weiss *et al.* to explain the collapse of the Upper Khabur polities and the Akkadian Empire. The timeframe of the collapse event is similar, for one thing, and late 3rd millennium climate change is a key component of both this model and the 4.2 ka hypothesis.

However, there are several important differences that distinguish this scenario from the 4.2 ka hypothesis which require further elaboration. First and foremost, while the 4.2 ka hypothesis emphasizes the centrality of climate change as *the* primary factor responsible for the collapse of the entire northern Mesopotamian region, in this model climate change is only one of several factors that were involved in the decline and abandonment of Tiriş Höyük. In the scenario I propose here, a cavalcade of other political, economic, social, and ideological inputs are considered to also be of critical importance. More significantly, it is the *conjecture* of these factors, rather than their mere existence, which is central to this new model for the collapse of Tiriş Höyük.

Another difference between this model and the 4.2 ka hypothesis is that while the latter presupposes a complete or near-complete failure of the rain-fed agriculture system as a result of severe and prolonged late 3rd millennium drought, in this model that need not have been the case. As I have explained above, the outright failure of the agricultural system of Titriş Höyük is not a precondition for the political collapse of the polity. In fact, I have argued that even a moderate reduction in cereal crop yields could have played an important role in the development or reinforcement of social friction, particularly in conjunction with the collapse of long-distance trade networks that may have indirectly helped to undermine the ideological basis for the city's social hierarchy.

11.4: Unanswered Questions and Directions for Future Research

Although the model presented above helps to clarify many aspects of the political collapse of Titriş Höyük, there are still a number of outstanding issues that must be left for future study. I will conclude this dissertation by addressing a few of the most important of these issues, and discussing the prospects for tackling them with future research. It bears mentioning that there are a number of questions pertaining to the social and political structure of Titriş Höyük and its secondary centers that would require future excavation to fully elucidate. These include, for example, the political structure of the state, and the precise role of its bureaucratic institutions in the economic management of the polity. Unfortunately, the vast majority of the Early Bronze Age urban centers in the Karababa Basin are now submerged beneath the

waters of the man-made Lake Atatürk. Furthermore, for a variety of reasons, it is very unlikely that any new excavations will take place at Titriş Höyük itself for the foreseeable future (Algaze, *pers. comm.*). Consequently, I will not discuss those questions here. Rather, I will instead focus only upon those issues that can be readily addressed with further research in the near-term future.

11.4.1: Refining the 3rd millennium paleoclimatic reconstruction for the Turkish Euphrates Valley. Given that this model is predicated partly on the contention that late 3rd millennium climate change in the Karababa Basin was a key causal factor for the collapse of Titriş Höyük, it would be very valuable to obtain further paleoclimate proxy information about the 3rd millennium climate history of the Karababa Basin and other neighboring areas. In so doing, it might become possible to better understand whether this shift did indeed take place, how it impacted settled agricultural populations, and whether a nomadic pastoralist lifestyle was more resilient to the effects of desiccation than that of the settled farmer, as we generally assume it was. Because this study employed stable carbon and oxygen isotope analysis of human and ovicaprid skeletal tissues to obtain its proxy data, I will confine this discussion to obtaining further isotope data from osseous tissues, as these data would be readily comparable to the information which is reported in Chapter 10 of this dissertation.

There are, fortunately, a considerable number of osteological materials available for analysis from sites in the Karababa Basin that could be employed in future isotope studies. For example, there are numerous osteological materials

obtained from the 1991-1998 excavation seasons at Titriş Höyük that were not analyzed in this study. The same is also true in the case of Gritille Höyük; a substantial portion of the Early Bronze Age faunal assemblage from that site, which was not included in this isotope analysis, could potentially also figure in future research.

In addition to generating new proxy data from the Karababa Basin, it would also be useful to place these data into a wider regional context by obtaining a body of stable carbon and oxygen isotope proxy data from archaeological sites in neighboring regions. Only by building a “mosaic” of many high-resolution datasets can we hope to ultimately develop an accurate picture of regional events that also accounts for the variations in microclimate change that have been observed in the proxy evidence reviewed in this study. Thus, the development of a climate “mosaic” of the Lower Turkish Euphrates Valley would serve two purposes: it would 1) provide a basis for comparison with the isotope data generated here; and 2) fill in further gaps in the regional 3rd millennium paleoclimate sequence for northern Mesopotamia.

One nearby site that has yielded a collection of osteological materials that could be analyzed is Kazane Höyük, the pre-eminent center of the Upper Balikh Valley immediately to the southeast of Titriş Höyük (near modern Şanlıurfa). This site, which was considerably larger than Titriş at ca. 100 ha, is generally believed by archaeologists to have been blessed with a particularly fertile plain, which accounts for its considerable size (cf. Wilkinson 2007: 39). It would be interesting, therefore, to discover whether this center experienced a climatic perturbation similar to that

observed in the Karababa Basin, and if so, what impacts, if any that this fluctuation had upon the peoples of the Upper Balikh.

11.4.2: Chronological concerns. Perhaps the most pressing need is to establish a more precise absolute chronology for the events that led up to the collapse and abandonment of Titriş. This study has made a first step towards such a chronology by obtaining a handful of new, more accurate AMS radiocarbon dates for the phases of occupation at the site. However, while this is surely a step forward in our understanding, there are many aspects of the collapse of Titriş that require a more precise chronology. For example, it would be very valuable to have a clearer sense of precisely how the climatic shift indicated by the human bioapatite stable isotope data unfolded over the course of the Late EBA.

The most straightforward (though not necessarily cost-effective) way to refine the existing absolute chronology for the Early Bronze Age in the Karababa Basin would be to obtain a much larger number of AMS dates, particularly for the Late EBA. An advantage to this technique is that a variety of organic materials could be sampled for analysis. The collection of a large quantity of calibrated AMS dates could potentially help to further constrain the chronological sequence of this critical period.

An alternative strategy that would be somewhat less expensive, but also not quite as reliable, would be to rely upon a combination of AMS radiocarbon and fluoride dating. Although fluoride dating – that is, the measure of fluorine concentrations in skeletal tissues – cannot produce reliable absolute chronometric dates in and of itself, it has proven useful as a precise relative dating technique for

populations where at least some samples are independently dated by other means (usually radiocarbon) (cf. Lyman *et al.*, 2012). Accordingly, if some skeletal tissue samples were dated with AMS, these could potentially be used as “anchors” for other bone and enamel samples, which could then be assigned chronometric dates relative to the more secure AMS ^{14}C dates.

11.4.3: The relative economic importance of various long-distance trade routes. While it is clear that in general, long-distance trade was critical to the economic viability of Titriş Höyük, it is not yet fully understood how important each of the various long-distance trade routes that funneled into the Karababa Basin were to the Titriş economy. Were all long-distance trade routes of relatively similar importance, or were some especially significant and others less so? How did the relative importance of various trade routes wax and wane over the course of the 3rd millennium? These issues deserve particular attention, as a greater understanding of which trade routes meant the most to Titriş may be of help in determining how the decline of other polities who also participated in these same routes might have affected the economic stability of Titriş.

Admittedly, it is difficult to assess the relative importance of various trade routes without the availability of texts. But given the number of metal objects unearthed in Titriş burials, and the fact that the chemical composition of some metals, such as copper, can be used to identify their original geographical source, compositional and lead isotope analysis of samples of these objects might be one way to access this information indirectly. These techniques have been used successfully on

Cyprus, for example, to demonstrate that despite the wealth of native copper on the island, at least some of the copper ingots found in Philia Phase/Early Cypriot contexts (2400-2000 BC) actually originated from sources in the Cyclades and southeastern Anatolia (cf. Webb *et al.*, 2006). It is conceivable that similar studies of metal objects from Tiritiş Höyük might also reveal the sources of the metal ores from which they were wrought, and thus, by extension, to assess which trade routes were of the highest importance in terms of obtaining metals and metal objects.

11.4.4: Prospects for future research: final thoughts. As the above examples illustrate, despite the inability to conduct further excavations in the Karababa Basin, the prospects of future research into the Early Bronze Age in this area are bright. Through these and other studies, the evidence concerning Early Bronze Age historical trajectories of Tiritiş Höyük and other centers in the Karababa Basin that has been presented in this volume can be considerably strengthened and expanded. In so doing, it will become possible not only to develop a greater understanding of the processes that contributed to the collapse of this particular urban center, but to provide a blueprint for future research projects that seek to delve into these same issues in other parts of northern Mesopotamia.

Just as importantly, future research projects that seek to further establish when and how Tiritiş Höyük collapsed will need to deal with the multiplicity of causal factors that were involved. I have highlighted four particular factors in this study, but in all likelihood there were also others that will also need to be accounted for in order to achieve a more complete understanding of the complicated history of this event.

One advantage of the Sewellian framework that forms the theoretical underpinnings of the model I have proposed here is that it can be easily adapted as the gathering of new evidence warrants. Consequently, it is my hope that the Sewellian approach will remain an integral feature of future models that seek not only to explain the complex causality of the political collapse of Tiriş Höyük, but also of other Early Bronze Age sites in northern Mesopotamia. In so doing, it will hopefully become possible to replace older, more simplistic models with nuanced ones that are more flexible and can be adjusted in accordance with the availability of new archaeological evidence, and, as a result, to develop a new and more sophisticated understanding of why so many polities in this fascinating and archaeologically significant region went into a rapid (and in many cases, terminal) decline during the final centuries of the 3rd millennium BC.

Bibliography

Abun-Nasr JM (1987) *A History of the Maghrib in the Islamic Period*. Cambridge University Press, Cambridge and New York.

Adams RM (1981) *Heartland of Cities: Surveys of Ancient Settlement and Land Use on the Central Floodplain of the Euphrates*. University of Chicago Press, Chicago and London.

Adams RM (1988) “Contexts of Civilizational Collapse: A Mesopotamian View.” In: Yoffee N, Cowgill GL [eds.] *The Collapse of Ancient States and Civilizations*. University of Arizona Press, Tucson: 20-43.

Adams RM (2007) “The Limits of State Power on the Mesopotamian Plain.” *Cuneiform Digital Library Bulletin* 1: 1-3.

Akkermans PMMG, Schwartz GM (2003) *The Archaeology of Syria: From Complex Hunter-Gatherers to Early Urban Societies (ca. 16,000-300 BC)*. Cambridge University Press, Cambridge.

Al-Timimi YK, Al-Jiboori MH (2013) “Assessment of spatial and temporal drought in Iraq during the period 1980–2010.” *International Journal of Energy and Environment* 4: 291–302.

Algaze G (1990) *Town and Country in Southeastern Anatolia. Volume II: The Stratigraphic Sequence at Kurban Höyük*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Algaze G (1991) “The Tigris-Euphrates Archaeological Reconnaissance Project, 1989-90.” *Anatolica* 17: 175-240.

Algaze G (1993) *The Uruk World System: The Dynamics of Expansion of Early Mesopotamian Civilization*. The University of Chicago Press, Chicago and London.

Algaze G (2001) “The Prehistory of Imperialism: The case of Uruk Period Mesopotamia.” In: Rothmann M [ed.] *Uruk Mesopotamia and its Neighbors: Cross-cultural Interactions and their Consequences in the Era of State Formation*. School of American Research, Santa Fe (NM): 27-85.

Algaze G (2008) *Ancient Mesopotamia at the Dawn of Civilization: The Evolution of an Urban Landscape*. The University of Chicago Press, Chicago and London.

Algaze G, Matney M (2011) “Titriş Höyük: The Nature and Context of Third Millennium B.C.E. Urbanism in the Upper Euphrates Basin.” In: Steadman SR,

McMahon G [eds.] *The Oxford Handbook of Ancient Anatolia*. Oxford University Press, Oxford and New York: 993-1011.

Algaze G, Mısır A, Wilkinson TJ (1992) “Şanlıurfa Museum/University of California Excavations and Surveys at Titriş Höyük, 1991: A Preliminary Report.” *Anatolica* 18: 33-60.

Algaze G, Breuninger R, Knudstad J (1994) “The Tigris-Euphrates Archaeological Reconnaissance Project: Final Report of the Birecik and Carchemish Dam survey areas.” *Anatolica* 20: 1-96.

Algaze G, Goldberg P, Honça D, Matney T, Mısır A, Rosen AM, Schlee D, Somers L (1995) “Titriş Höyük, A Small EBA Urban Center in SE Anatolia: The 1994 Season.” *Anatolica* 21: 13-64.

Algaze G, Kelly J, Matney T, Schlee D (1996) “Late EBA Urban Structure at Titriş Höyük, Southeastern Turkey: The 1995 Season.” *Anatolica* 22: 129-144.

Algaze G, Dinckan G, Hartenberger B, Matney T, Pournelle J, Rainville L, Rosen S, Rupley E, Schlee D, Vallet R (2001) “Research at Titriş Höyük in Southeastern Turkey: The 1999 Season.” *Anatolica* 27: 23-106.

Allentuck A, Greenfield HJ, (2010) “The Organization of Animal Production in an Early Urban Center: The Zooarchaeological Evidence from Early Bronze Age Titriş Höyük, Southeastern Turkey.” In: Campana D, Crabtree P, deFrance SD, Lev-Tov J, Choyke A [eds.] *Anthropological Approaches to Zooarchaeology*. Oxbow Books, London: 12-29.

Ambrose SH (1991) “Effects of diet, climate and physiology on nitrogen isotope ratios in terrestrial foodwebs.” *Journal of Archaeological Science* 18: 293-317.

Ambrose SH, Norr L (1993) “Experimental Evidence for the Relationship of the Carbon Isotope Ratios of Whole Diet and Dietary Protein to those of Bone Collagen and Carbonate.” In: Lambert JB, Grupe G [eds.], *Prehistoric Human Bone: Archaeology at the Molecular Level*. Springer-Verlag, New York: 1-37.

Archer D (2010) *The Global Carbon Cycle*. Princeton University Press, Princeton (NJ).

Archi A (2000) “The ‘Lords’, Lugal-Lugal, of Ebla: A Prosopographic Study.” *Vicino Oriente* 12: 19-58.

- Archi A** (2001) "The King-Lists From Ebla." In: Abusch T, Noyes C, Hallo WW [eds.] *Proceedings of the XLV Rencontre Assyriologique Internationale: Historiography of the Cuneiform World*. CDL Press, Bethesda (MD): 1-13.
- Arz HW, Lamy F, Pätzold J** (2006) "A pronounced dry event recorded around 4.2 ka in brine sediments from the northern Red Sea." *Quaternary Research* 66: 432-441.
- Baines J, Yoffee N** (1998) "Order, Legitimacy and Wealth in Ancient Egypt and Mesopotamia." In: Feinman GM, Marcus J [eds.] *Archaic States*. School of American Research Press, Santa Fe (NM): 199-260.
- Balbo AL, Andrič M, Rubinić J, Moscariello A, Miracle PT** (2006) "Palaeoenvironmental and Archaeological Implications of a Sediment Core from Polje Čepić, Istria, Croatia." *Geologica Croatica* 59 (No. 2): 109-124.
- Bar-Matthews M, Ayalon A** (2011) "Mid-Holocene climate variations revealed by high-resolution speleothem records from Soreq Cave, Israel and their correlation with cultural changes." *The Holocene* 21 (No. 1): 163-171.
- Barry R** (2008) *Mountain Weather and Climate*. Cambridge University Press, Cambridge and New York.
- Beck Jr. RA, Bolender DJ, Brown JA, Earle TK** (2007) "Eventful Archaeology: The Place of Space in Structural Transformation." *Current Anthropology* 48 (No. 6): 833-860.
- Berthon R, Mashkour M** (2008) "Animal Remains From Tilbeşar Excavations, Southeast Anatolia, Turkey." *Anatolia Antiqua* 16: 23-51.
- Bigelow L** (1999) "Zooarchaeological Investigations of Economic Organization and Ethnicity at Late Chalcolithic Hacinebi: A Preliminary Report." *Paléorient* 25 (No. 1): 83-89.
- Binford LR** (1968) "Some Comments on Historical Versus Processual Archaeology." *Southwestern Journal of Anthropology* 24 (No. 3): 267-275.
- Boerma JAK** (1988) "Soils and Environment of Tell Hammam et-Turkman." In: Van Loon MN [ed.] *Hammam et-Turkman I: Report on the University of Amsterdam's 1981-84 Excavations in Syria*. Nederlands Historisch-Archaeologisch Instituut te Istanbul, Istanbul: 1-12.
- Bottema S, Cappers RTJ** (2000) "Palynological and Archaeobotanical Evidence from Bronze Age Northern Mesopotamia." In: Jas RM [ed.] *Rainfall and Agriculture in Northern Mesopotamia*. Nederlands Instituut voor het Nabije Oosten, Leiden: 37-70.

Bowen GJ, Cerling TE, Ehleringer JR (2007) Stable Isotopes and Human Water Resources: Signals of Change.” In: Dawson TE, Siegwolf RTW [eds.] *Stable Isotopes as Indicators of Ecological Change*. Academic Press, Inc., London: 285-300.

Braidwood RJ, Braidwood LS (1960) *Excavations in the Plain of Antioch I: The Earlier Assemblages, Phases A to J*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Bretschneider J, Van Lerberghe K (2008) “Tell Tweini, ancient Gibala, between 2600 B.C.E. and 333 B.C.E.” In: Bretschneider J, Van Lerberghe K [eds.] *In Search of Gibala, an archaeological and historical study based on eight seasons of excavations at Tell Tweini (1999–2007) in the A and C fields*. Aula Orientalis, Barcelona: 12–66.

Broodbank C (2013) *The Making of the Middle Sea: A History of the Mediterranean from the Beginning to the Emergence of the Classical World*. Oxford University Press, Oxford.

Bryant JD, Koch PL, Froelich PN, Showers WJ, Genn, BJ (1996) “Oxygen isotope partitioning between phosphate and carbonate in mammalian apatite.” *Geochimica et Cosmochimica Acta* 60 (No. 24): 5145-5148.

Butzer KW (1997) “Sociopolitical Discontinuity in the Near East, c. 2200 B.C.E.: Scenarios for Palestine and Egypt.” In: Dalfes HN, Kukla G, Weiss H [eds.] *Third Millennium BC Climate Change and Old World Collapse*. Springer Verlag, Heidelberg: 245-96.

Butzer KW (2012) “Collapse, environment, and society.” *Proceedings of the National Academy of Sciences* 109 (No. 10): 3632-3639.

Çakırlar C, Şeşen R (2013) “Reading between the lines: $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ isotopes of *Unio elongatulus* shell increments as proxies for local palaeoenvironments in mid-Holocene northern Syria.” *Archaeological and Anthropological Sciences* 5: 85–94.

Cerling TE, Harris JM (1999) “Carbon isotope fractionation between diet and bioapatite in ungulate mammals and implications for ecological and paleoecological studies.” *Oecologia* 120: 347-363.

Cerling TE, Harris JM, Passey BH (2003) “Carbon isotope fractionation between diet and bioapatite in ungulate mammals and implications for ecological and paleoecological studies.” *Oecologia* 120: 347-363.

- Charles M, Bogaard A** (2001) "Third-Millennium BC Charred Plants Remains From Tell Brak". In: Oates D, Oates J, McDonald H [eds.] (2001) *Excavations at Tell Brak. Vol. 2: Nagar in the Third Millennium BC*. Oxbow Books, Oxford: 301-326.
- Colombaroli D, Tinner W, van Leeuwen J, Noti R, Vescovi E, Vanière B, Magny M, Schmidt R, Bugmann H** (2009) "Response of broadleaved evergreen Mediterranean forest vegetation to fire disturbance during the Holocene: insights from the peri-Adriatic region." *Journal of Biogeography* 36: 314-326.
- Coombes P, Barber K** (2005) "Environmental determinism in Holocene research: causality or coincidence?" *Area* 37 (No. 3): 303-311.
- Cooper JS** (1983) *The Curse of Agade*. The Johns Hopkins University Press, Baltimore and London.
- Cooper JS** (1986) *Sumerian and Akkadian Royal Inscriptions I: Presargonic Inscriptions*. The American Oriental Society, New Haven (CT).
- Cooper JS** (2008) "Divine Kingship in Mesopotamia, A Fleeting Phenomenon." In: Brisch N [ed.] *Religion and Power: Divine Kingship in the Ancient World and Beyond*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL): 261-266.
- Cooper L** (2006) *Early Urbanism on the Syrian Euphrates*. Routledge Publishing, London and New York.
- Crawford HEW** (1973) Mesopotamia's Invisible Exports in the Third Millennium, B.C." *World Archaeology* 5, No 2 ("Trade"): 232-241.
- Cullen HM, deMenocal PB** (2000) "North Atlantic Influence on Tigris-Euphrates Streamflow." *International Journal of Climatology* 20: 853-863.
- Cullen HM, deMenocal PB, Hemming S, Hemming G, Brown FH, Guilderson T, Sirocko F** (2000) "Climate change and the collapse of the Akkadian Empire: Evidence from the deep sea." *Geology* 28 (No. 4): 379-382.
- Dansgaard W** (1964) "Stable isotopes in precipitation." *Tellus* 16 (No. 4): 436-468.
- Deckers K, Pessin H** (2010) "Vegetation development in the Middle Euphrates and Upper Jazirah (Syria/Turkey) during the Bronze Age." *Quaternary Research* 74: 216-226.
- Deckers K, Pessin H** (2011) "Vegetation development, human occupation and climate change in the Middle Euphrates and Upper Jazirah (Syria/Turkey) During the Bronze

Age.” In: Deckers K [ed.] *Holocene Landscapes Through Time in the Fertile Crescent*. Brepols Publishers, Turnhout, Belgium: 33-48.

deMenocal PB (2001) “Cultural Responses to Climate Change During the Late Holocene.” *Science* 292: 667-673.

Demir T, Westaway R, Brdligland DR, Seyrek A (2007) “Terrace staircases of the River Euphrates in southeast Turkey, northern Syria and western Iraq: evidence for regional surface uplift.” *Quaternary Science Reviews* 26: 2844–2863.

DeNiro MJ, Epstein S (1978) “Influence of Diet on the Distribution of Carbon Isotopes in Animals.” *Geochimica et Cosmochimica Acta* 42: 495-506.

Di Rita F, Magri D (2009) “Holocene drought, deforestation and evergreen vegetation development in the central Mediterranean: a 5500 year record from Lago Alimini Piccolo, Apulia, southeast Italy.” *The Holocene* 19 (No. 2): 295-306.

Diamond J (1987) “The Worst Mistake in the History of the Human Race.” *Discover Magazine*, May 1987: 95-98.

Dirican A, Ünal S, Acar Y, Demircan M (2005) “The temporal and seasonal variation of H-2 and O-18 in atmospheric water vapour and precipitation from Ankara, Turkey in relation to air mass trajectories at Mediterranean Basin.” In: Gourcy, L. [ed.] *Isotopic composition of precipitation in the Mediterranean Basin in relation to air circulation patterns and climate: Final report of a coordinated research project 2000–2004*. IAEA, Vienna: 191-214.

DuBois TA (1999) *Nordic Religions in the Viking Age*. University of Pennsylvania Press, Philadelphia.

Dumont HJ, El Moghraby AI (1993) “Holocene Evolution of Climate and Environment, and Stone “City” Ruins in Norther Darfur, Sudan: Is There A Relationship?.” In: Krzyżaniak L, Kobusiewicz M, Alexander J [eds.] *Environmental Change and Human Culture in the Nile Basin and Northern Africa Until the Second Millennium B.C.* Poznań Archaeological Museum (Studies in African Archaeology: Vol. 4), Poznań: 381-398.

Eastwood WJ, Leng MJ, Roberts N, Davis B (2007) “Holocene climate change in the eastern Mediterranean region: a comparison of stable isotope and pollen data from Lake Göllühisar, southwest Turkey.” *Journal of Quaternary Science* 22 (No. 4): 327-341.

Ekholm K, Friedman J (1979) “‘Capital’ Imperialism and Exploitation in Ancient World Systems.” In: Larsen MT [ed.] *Power and Propaganda: A Symposium on Ancient Empires*. Akademisk Forlag, Copenhagen: 41-58.

Erarslan A (2009) “Local Settlement Transitions in Southeastern Anatolia during the Late Third and Early Second Millennium BC.” *Altoriental. Forsch.*, Akademie Verlag 36 (No. 2): 268–292.

Erdal ÖD (2010) “A Possible Massacre at Early Bronze Age Titriş Höyük, Anatolia.” *International Journal of Osteoarchaeology*, 22 (No. 1): 1-21.

Erdal, YS, Erdal ÖD (2012) “Organized violence in Anatolia: A retrospective research on the injuries from the Neolithic to Early Bronze Age.” *International Journal of Paleopathology* 2: 78– 92.

Figs O (1996) *A People’s Tragedy: The Russian Revolution 1891-1924*. Penguin Books, New York.

Finné M, Holmgren K, Sundqvist HS, Weiberg E, Lindblom M (2011) “Climate in the eastern Mediterranean, and adjacent regions, during the past 6000 years – A review.” *Journal of Archaeological Science* 38: 3153-3173.

Finkel C (2005) *Osman’s Dream: A History of the Ottoman Empire*. Basic Books, New York.

Flannery KV (1972) “The Cultural Evolution of Civilizations.” *Annual Review of Ecology and Systematics* 3: 399-426.

Fleitmann D, Burns SJ, Mudelsee M, Neff U, Kramers J, Mangini A, Matter A (2003) “Holocene forcing of the Indian monsoon recorded in a stalagmite from southern Oman.” *Science* 300: 1737-1739.

Foster BR (1982) *Umma in the Sargonic Period*. Published for the Connecticut Academy of Arts and Sciences by Archon Books, Hamden (CT).

Fricke HC, O’Neill JR (1996) “Inter- and intra-tooth variation in the oxygen isotope composition of mammalian tooth enamel phosphate: implications for palaeoclimatological and palaeobiological research.” *Palaeogeography, Palaeoclimatology, Palaeoecology*, 126: 91-99.

Fried MH (1967) *The Evolution of Political Society*. Random House, Inc., New York.

Friedman J (1990) “Being in the World: Globalization and Localization.” *Theory, Culture & Society* 7: 311-328.

- Friedman J** (1998) “Transnationalization, Socio-political Disorder, and Ethnification as Expressions of Declining Global Hegemony.” *International Political Science Review* 19 (No. 3): 233-250.
- Froehle AW, Kellner CM, Schoeninger MJ** (2010) “FOCUS: effect of diet and protein source on carbon stable isotope ratios in collagen: follow up to Warinner and Tuross (2009).” *Journal of Archaeological Science* 37: 2662-2670.
- Fry B** (2006) *Stable Isotope Ecology*. Springer Science + Business Media, LLC, New York.
- Gat JR** (1996) “Oxygen and Hydrogen Isotopes in the Hydrologic Cycle.” *Annual Review of Earth and Planetary Sciences* 24: 225-262.
- Gehler A, Tütken T, Pack A** (2012) “Oxygen and Carbon Isotope Variations in a Modern Rodent Community – Implications for Palaeoenvironmental Reconstructions.” *PLoS ONE* 7 (No. 11): 1-13.
- Gibbon E** (1776-88) *Decline and Fall of the Roman Empire*.
- Grove AT, Rackham O** (2001) *The Nature of Mediterranean Europe: An Ecological History*. Yale University Press, New Haven (CT) and London.
- Hald MM** (2010) “Distribution of crops at late Early Bronze Age Titriş Höyük, southeast Anatolia: towards a model for the identification of consumers of centrally organised food distribution.” *Vegetation History and Archaeobotany* 19: 69-77.
- Hallin KA, Schoeninger MJ, Schwarcz HP** (2012) “Paleoclimate during Neanderthal and anatomically modern human occupation at Amud and Qafzeh, Israel: the stable isotope data.” *Journal of Human Evolution* 62: 59-73.
- Hawkins JD** (1983) “Review: [untitled] of *Ebla: An Empire Rediscovered* by Paolo Matthiae.” *Bulletin of the School of Oriental and African Studies, University of London* 46 (No. 3): 547-548.
- Heaton THE, Vogel JC, von la Chevallerie G, Collett G** (1986) “Climatic Influence on the Isotopic Composition of Bone Nitrogen.” *Nature* 322: 822-823.
- Hedges REM** (2002) “Bone Diagenesis: An Overview of Processes.” *Archaeometry* 44: 319-328.
- Heimpel W** (2009) *Workers and Construction Work at Garšana*. CDL Press, Bethesda (MD).

Heinz M (2007) “Sargon of Akkad: rebel and usurper in Kish.” In: Heinz M [ed.] *Representations of political power: case histories from times of change and dissolving order in the Ancient Near East*: Eisenbrauns, Winona Lake (IN): 67-86

Helms MW (1988) *Ulysses' Sail: An Ethnographic Odyssey of Power, Knowledge, and Geographical Distance*. Princeton University Press, Princeton (NJ).

Helms MW (1993) *Craft and the Kingly Ideal: Art, Trade, and Power*. University of Texas Press, Austin (TX).

Hodder I (1982) *Symbolic and Structural Archaeology*. Cambridge University Press, Cambridge and New York.

Hodder I (1987) *The Archaeology of Contextual Meanings*. Cambridge University Press, Cambridge and New York.

Hodder I (1991) “Interpretive Archaeology and Its Role.” *American Antiquity* 56 (No. 1): 7-18.

Hoefs J (2007) *Stable Isotope Geochemistry*. Springer-Verlag, Berlin.

Holland TA [ed.] (2006) *Excavations at Tell es-Sweyhat, Syria: Volume 2*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Holling CS (2001) “Understanding the Complexity of Economic, Ecological, and Social Systems.” *Ecosystems* 4: 390-405.

Hollund HI, Ariese F, Fernandes R, Jans MME, Kars H (2013) Testing an Alternative High-Throughput Tool for Investigating Bone Diagenesis: FTIR in Attenuated Total Reflection (ATR) Mode.” *Archaeometry* 55 (No. 3): 507-532.

Izdebski A, Holmgren K, Weiberg E, Stocker SR, Büntgen U, Florenzano A, Gogou A, Leroy SAG, Luterbacher J, Martrat B, Masi A, Mercuri AM, Montagna P, Sadori L, Schneider AW, Sicre M-A, Triantaphyllou M, Xoplaki E (2015) “Realising consilience. How better communication between archaeologists, historians and geoscientists can transform the study of past climate change in the Mediterranean.” *Quaternary Science Reviews*, forthcoming.

Jacobsen T (1976) *The Treasures of Darkness: A History of Mesopotamian Religion*. Yale University Press, New Haven (CT).

Jacobsen T (1976 [1944]) “Mesopotamia.” In: Frankfort H, Frankfort HA, Wilson JA, Jacobsen T, Irwin WA [eds.] *The Intellectual Adventure of Ancient Man: An*

Essay on Speculative Thought in the Ancient Near East. University of Chicago Press, Chicago (IL) and London.

Jahns S (2002) "An improved time scale for the Holocene history of vegetation and environment on the South Dalmatian Island of Mljet." *Vegetation History and Archaeobotany* 11: 315-316.

Jahns S, van den Bogaard C (1998) "New palynological and tephrostratigraphical investigations of two salt lagoons on the island of Mljet, south Dalmatia, Croatia." *Vegetation History and Archaeobotany* 7: 219-234.

Kaniewski D, Paulissen E, Van Campo E, Al-Maqdissi M, Bretschneider J, Van Lerberghe K (2008) "Middle East coastal ecosystem response to middle-to-late Holocene abrupt climate changes." *Proceedings of the National Academy of Sciences* 105 (No. 37): 13941-13946.

Katsoulis BD, Makrogiannis TJ, Goutsidou YA (1998) "Monthly Anticyclonicity in Southern Europe and the Mediterranean Region." *Theoretical and Applied Climatology* 59 (No. 1): 51-59.

Kellner CM, Schoeninger MJ (2007) "A Simple Carbon Isotope Model for Reconstructing Prehistoric Human Diet." *American Journal of Physical Anthropology* 133: 1112-1127.

Knapp AB (1996) "Archaeology Without Gravity: Postmodernism and the Past." *Journal of Archaeological Method and Theory* 3 (No. 2): 127-158.

Koch PL, Tuross N, Fogel ML (1997) "The effects of sample treatment and diagenesis on the isotopic integrity of carbonate in biogenic hydroxylapatite." *Journal of Archaeological Science* 24: 417-429.

Koch O, Tschirko D, Kandeler E (2007) "Temperature Sensitivity of Microbial Respiration, Nitrogen Mineralization, and Potential Soil Enzyme Activities in Organic Alpine Soils." *Global Biogeochemical Cycles* 21: 1-11.
DOI:10.1029/2007GB002983.

Kohn MJ, Schoeninger MJ, Valley JW (1996) "Herbivore tooth oxygen isotope compositions: Effects of diet and physiology." *Geochimica et Cosmochimica Acta* 60 (No. 20): 3889-3896.

Kohn MJ, Schoeninger MJ, Valley JW (1998) "Variability in oxygen isotope compositions of herbivore teeth: reflections of seasonality or developmental physiology?" *Chemical Geology* 152: 97- 112.

Kohn MJ (2010) “Carbon isotope compositions of terrestrial C3 plants as indicators of (paleo)ecology and (paleo)climate.” *Proceedings of the National Academy of Sciences* 107 (No. 46): 19691-19695.

Kotthoff U, Müller UC, Pross J, Schmiedl G, Lawson IT, van de Schootburgge B, Schulz H (2008) “Lateglacial and Holocene vegetation dynamics in the Aegean region: an integrated view based on pollen data from marine and terrestrial archives.” *The Holocene*: 18 (No. 7): 1019-1032.

Kristiansen K, Larsson TB (2005) *The Rise of Bronze Age Society: Travels, Transmissions and Transformations*. Cambridge University Press, Cambridge and New York.

Kuzucuoglu C, Fontugne M, Mouralis D (2004) “Holocene terraces in the Middle Euphrates Valley, between Halfeti and Karkemish (Gaziantep, Turkey).” *Quaternaire* 15 (No. 1-2): 195-206.

Kuzucuoglu C, Dörfler W, Kunesch S, Goupille F (2011) “Mid- to late-Holocene climate change in central Turkey: The Tecer Lake record.” *The Holocene* 21: 173-188.

Lamb AL, Leng MJ, Lamb HF, Mohammed MU (2000) “A 9000-year oxygen and carbon isotope record of hydrological change in a small Ethiopian crater lake.” *The Holocene* 10: 167.

Landmann G, Reimer A, Lemcke G, Kempe S (1996) “Dating Late Glacial abrupt climate changes in the 14,570 yr long continuous varve record of Lake Van, Turkey.” *Palaeogeography, Palaeoclimatology, Palaeoecology* 122: 107-118.

Laneri N (2007) “Burial Practices at Titriş Höyük: An Interpretation.” *Journal of Near Eastern Studies* 66 (No. 4): 241-266.

Lee-Thorp JA, Sealy JC, van der Merwe NJ (1989) “Stable Carbon Isotope Ratio Differences Between Bone Collagen and Bone Apatite, and Their Relationship to Diet.” *Journal of Archaeological Science* 16 (No. 6): 585-599.

Liverani M (1995) “The Deeds of Ancient Mesopotamian Kings.” In: Sasson JM [ed.] *Civilizations of the Ancient Near East*. Scribner's, New York: 2352-2366.

Longinelli A (1984) “Oxygen Isotopes in Mammal Bone Phosphate: A New Tool for Paleohydrological and Paleoclimatological Research?” *Geochimica et Cosmochimica Acta* 48: 385-390.

Loosli JK, McDowell LR (1985) “The Role of Ruminants in Warm Climates.” In: McDowell LR [ed.], *Nutrition of Grazing Ruminants in Warm Climates*. Academic Press, Inc., Orlando (FL): 1-20.

Lovelock PER (1984) “A review of the tectonics of the Northern Middle East Region.” *Shell International Petroleum Maatschappij B. V., Exploration and Production Report*.

Lyman RL, Rosania CN, Boulanger MT (2012) “Comparison of fluoride and direct AMS radiocarbon dating of black bear bone from Lawson Cave, Missouri.” *Journal of Field Archaeology* 37 (No. 3): 226-237.

Macklin MG, Tooth S, Brewer PA, Noble PL, Duller GAT (2010) “Holocene flooding and river development in a Mediterranean steep-land catchment: The Anapodaris Gorge, south central Crete, Greece.” *Global and Planetary Change* 70: 35–52.

Magid G (2006) “Sumerian Early Dynastic Royal Inscriptions.” In: Chavalas MW [ed.] *The Ancient Near East*. Blackwell Publishing, Oxford: 4-16.

Mallowan MEL (1946) “Excavations in the Balikh Valley (1938).” *Iraq* 8: 111—156.

Malthus TR (1798 [1993]) *An Essay on the Principle of Population*. Oxford University Press (Oxford World’s Classics Edition), Oxford and New York.

Marchesi G (2015b) “History and Philology.” In: Finkbeiner U, Novák M, Sakal F, Sconzo P [eds.] *Middle Euphrates*. (ARCANE Series #4.) Brepols Publishers, Turnhout, Belgium: 423-430.

Marinova E, Tonkov S, Bozilova, Vajsov I (2012) “Holocene anthropogenic landscapes in the Balkans: the palaeobotanical evidence from southwestern Bulgaria.” *Vegetation History and Archaeobotany* 21: 413-427.

Matney T (2002) “Urban Planning and the Archaeology of Society at Early Bronze Age Titriş Höyük.” In: Hopkins DC [ed.] *Across the Anatolian Plateau: Readings in the Archaeology of Ancient Turkey*. American Schools of Oriental Research (The Annual of the American Schools of Oriental Research, Vol. 57), Boston (MA): 19-34.

Matney T, Algaze G, Pittman H (1997) “Excavations at Titriş Höyük in Southeastern Turkey: A Preliminary Report of the 1996 Season.” *Anatolica* 23: 61-84.

Matney T, Algaze G, Rosen SA (1999) “Early Bronze Age Urban Structure at Titriş Höyük, Southeastern Turkey: The 1998 Season.” *Anatolica* 25: 185-201.

- Mayhew** RJ (2014) *Malthus: The Life and Legacies of an Untimely Prophet*. Belknap/Harvard Press, Cambridge (MA) and London.
- McAnany** PA, Yoffee N (2010) *Questioning Collapse: Human Resilience, Ecological Vulnerability, and the Aftermath of Empire*. Cambridge University Press, Cambridge and New York.
- McCorrison** J (1998) “Landscape and Human-environment Interaction in the Middle Habur Drainage from the Neolithic Period to the Bronze Age.” In: Pouilloux J [ed.] *Travaux de la Maison de l'Orient méditerranéen*. Maison de l'Orient et de la Méditerranée, Lyon: 1-2.
- McDonald** H (2001) “Third Millennium Beads and Pendants.” In: Oates D, Oates J, McDonald H [eds.] *Excavations at Tell Brak. Vol. 2: Nagar in the Third Millennium BC*. Oxbow Books, Oxford: 225-232.
- McClellan** TL, Porter A (1999) “Survey of Excavations at Tell Banat: Funerary Practices.” In: del Olmo Lete G, Montero Fenollós J-L [eds.] *Archaeology of the Upper Syrian Euphrates: The Tishrin Dam Area*. Aula Orientalis, Barcelona: 107-116.
- McNeill** WH (1976) *Plagues and Peoples*. Anchor Books, New York.
- Mees** F, Verschuren D, Nijs R, Dumont H (1991) “Holocene evolution of the crater lake at Malha, Northwest Sudan.” *Journal of Paleolimnology* 5: 227-253.
- Meggers** BJ (1960) “The Law of Cultural Evolution as a Practical Research Tool.” In: Dole G, Carneiro R [eds.] *Essays in the Science of Culture*. Crowell, New York: 302-316.
- Michalowski** P (2008) “The Mortal Kings of Ur: A Short Century of Divine Rule in Ancient Mesopotamia.” In: Brisch N [ed.] *Religion and Power: Divine Kingship in the Ancient World and Beyond*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL): 33-46.
- Migowski** C, Stein M, Prasad S, Negendank JFW, Agnon A (2006) “Holocene climate variability and cultural evolution in the Near East from the Dead Sea sedimentary record.” *Quaternary Research* 66: 421–431.
- Milano** L (1995) “Ebla: A Third Millennium City-State in Ancient Syria.” In: Sasson JM [ed.] *Civilizations of the Ancient Near East*. Charles Scribner's Sons, New York (NY): 1219-1230.

Miller NF (2008) “Sweeter Than Wine?: The Use of the Grape in Early Western Asia.” *Antiquity* 82: 937-946.

Mitchell P (2005) *African Connections: Archaeological Perspectives on Africa and the Wider World*. AltaMira Press, Lanham (MD).

Montero Fenollós J-L (1999) “Metallurgy in the Valley of the Syrian Upper Euphrates During the Early and Middle Bronze Ages.” In: del Olmo Lete G, Montero Fenollós J-L [eds.] *Archaeology of the Upper Syrian Euphrates: The Tishrin Dam Area*. Aula Orientalis, Barcelona: 443-469.

Moody RA (1996) “Reexamining Brain Drain from the Former Soviet Union.” *The Nonproliferation Review* 3 (No. 3): 92-97.

Moorey PRS (1994) *Ancient Mesopotamian Materials and Industries*. Clarendon Press, Oxford.

Muhly JD (1993) “Early Bronze Age Tin and the Taurus.” *American Journal of Archaeology* 97 (No. 2): 239-253.

Nielsen-Marsh CM, Hedges REM (2000a) “Patterns of Diagenesis in Bone I: The Effects of Site Environments.” *Journal of Archaeological Science* 27: 1139-1150.

Nielsen-Marsh CM, Hedges REM (2000b) “Patterns of Diagenesis in Bone II: Effects of Acetic Acid Treatment and the Removal of Diagenetic CO₂.” *Journal of Archaeological Science* 27: 1151-1159.

O’Leary MH (1981) “Carbon Isotope Fractionation in Plants.” *Phytochemistry* 20 (No. 4): 553-567.

O’Leary MH (1988) “Carbon Isotopes in Photosynthesis.” *BioScience* 38 (No. 5): 328-336.

Oates D, Oates J, McDonald H [eds.] (2001) *Excavations at Tell Brak. Vol. 2: Nagar in the Third Millennium BC*. Oxbow Books, Oxford.

Oded B (1979) *Mass Deportations and Deportees in the Neo-Assyrian Empire*. Dr. Ludwig Reichert Verlag, Wiesbaden.

Ökse T (2011) “The Early Bronze Age in Southeastern Anatolia.” In: Steadman SR, McMahon G [eds.] *The Oxford Handbook of Ancient Anatolia*. Oxford University Press, Oxford and New York: 260-289.

Patterson TC (2009) *Karl Marx, Anthropologist*. Berg Publishers, London.

Pauketat TR (2001) "Practice and History in Archaeology: An Emerging Paradigm." *Anthropological Theory* 1 (No. 1): 73-98.

Pennell CR (2003) *Morocco: From Empire to Independence*. Oneworld Publications, London.

Pettinato G (1981) *The Archives of Ebla: An Empire Inscribed in Clay*. Doubleday and Company, Inc., Garden City (NY).

Pollock S (2003) "Feasts, Funerals, and Fast Food in Early Mesopotamian Societies." In: Bray TL [ed.] *The Archaeology and Politics of Food and Feasting in Early States and Empires*. Kluwer Academic/Plenum Publishers, New York (NY): 17-38.

Postgate JN (1992) *Early Mesopotamia: Society and Economy at the Dawn of History*. Routledge Publishing, London and New York.

Potts DT (2014) *Nomadism in Iran: From Antiquity to the Modern Era*. Oxford University Press, Oxford.

Rappaport R (1977) "Maladaptation in Social Systems." In: Friedman J, Rowlands M [eds.] *Evolution in Social Systems*. Duckworth, London: 49-71.

Reculeau H (2001) *Climate, Environment and Agriculture in Assyria*. Harrasowitz Verlag, Wiesbaden.

Redman CL (2005) "Resilience Theory in Archaeology." *American Anthropologist* 107 (No. 1): 70-77.

Redman CL, Kinzig AP (2003) "Resilience of Past Landscapes: Resilience Theory, Society, and the *Longue Durée*." *Conservation Ecology* 7 (No. 1): 14, online: <http://www.consecol.org/vol7/iss1/art14/>.

Renfrew C (2006) Inception of agriculture and rearing in the Middle East." *Comptes Rendus Palevol* 5: 395-404.

Richards MP, Hedges REM (1999) "Stable Isotope Evidence for Similarities in the Types of Marine Foods Used by Late Mesolithic Humans at Sites Along the Atlantic Coast of Europe." *Journal of Archaeological Science* 26: 717-722.

Riehl S (2009) "Archaeobotanical evidence for the interrelationship of agricultural decision-making and climate change in the ancient Near East." *Quaternary International* 197: 93-114.

Riehl S, Bryson R, Pustovoytov K (2008) “Changing growing conditions for crops during the Near Eastern Bronze Age (3000e1200 BC): the stable carbon isotope evidence.” *Journal of Archaeological Science* 35: 1011-1022.

Riehl S, Pustovoytov KE, Hotchkiss S, Bryson RA (2009) “Local Holocene environmental indicators in Upper Mesopotamia: Pedogenic carbonate record vs. archaeobotanical data and archaeoclimatological models.” *Quaternary International* 209: 154-162.

Roberts N, Reed JM, Leng MJ, Kuzucuoğlu C, Fontugne M, Bertaux J, Woldring H, Bottema S, Black S, Hunt E, Karabiyikoğlu M (2001) “The tempo of Holocene climatic change in the eastern Mediterranean region: new high- resolution crater-lake sediment data from central Turkey.” *The Holocene* 11: 721-736.

Roberts N, Brayshaw D, Kuzucuoğlu C, Perez R, Sadori L (2011) “The mid-Holocene climatic transition in the Mediterranean: Causes and consequences.” *The Holocene* 21 (No. 1): 3-13.

Rosen AM (1995) “The Social Response to Environmental Change in Early Bronze Age Canaan.” *Journal of Anthropological Archaeology* 14: 26-44.

Rowton MB (1973) “Urban Autonomy in a Nomadic Environment.” *Journal of Near Eastern Studies* 32 (No. 1-2): 201-215.

Rowton MB (1974) “Enclosed Nomadism.” *Journal of the Economic and Social History of the Orient* 17 (No. 1): 1-30.

Sallaberger W (1996) “Grain Accounts: Personnel Lists and Expenditure Documents.” In: Ismail F, Sallaberger W, Talon P, van Lerberghe K [eds.] *Administrative Documents from Tell Beydar (Seasons 1993- 1995)*. Brepols Publishers, Turnhout, Belgium: 89-106.

Sallaberger W (2004) “A Note on Sheep and Goat Flocks. Introduction to Texts 151-167.” In: Milano L, Sallaberger W, Talon P, van Lerberghe K [eds.] *Third Millenium Cuneiform Texts from Tell Beydar (Seasons 1996-2002)*. Brepols Publishers, Turnhout, Belgium: 13-22.

Santley RS, Alexander RT (1992) “The Political Economy of Core-Periphery Systems” in Schortman EM, Urban, PA [eds.] *Resources, Power, and Interregional Interaction*. Plenum Press, New York and London: 23-49.

Şahoğlu V (2005) “The Anatolian Trade Network and the Izmir Region During the Early Bronze Age.” *Oxford Journal of Archaeology* 24 (No. 2): 339-361.

- Şahoğlu V** (2011) "Trade and Interconnections Between Anatolia and the Cyclades During the 3rd Millennium BC." In: Şahoğlu V, Sotirakopoulou P [eds.] *ACROSS: The Cyclades and Western Anatolia During the 3rd Millennium BC*. Sakıp Sabancı Müzesi, Istanbul: 172-177.
- Scarborough V** (2009) "The Archaeology of Sustainability: Mesoamerica." *Ancient Mesoamerica* 20: 197-203.
- Schama S** (1989) *Citizens: A Chronicle of the French Revolution*. Vintage Books, New York.
- Schmidt R**, Müller J, Drescher-Schneider R, Krisai R, Szeroczyńska K, Barić A (2000) "Changes in lake level and trophy at Lake Vrana, a large karstic lake on the Island of Cres (Croatia), with respect to palaeoclimate and anthropogenic impacts during the last approx. 16,000 years." *Journal of Limnology* 59 (No. 2): 113-130.
- Schneider AW**, Adalı SF (2014) "'No Harvest Was Reaped': Demographic and Climatic Factors in the Decline of the Neo-Assyrian Empire." *Climatic Change* 127 (Nos. 3-4): 435-446.
- Schoeninger MJ**, DeNiro MJ, Tauber H (1983) "Stable Nitrogen Isotope Ratios of Bone Collagen Reflect Marine and Terrestrial Components of Human Diet." *Science (New Series)* 220 (No 4604): 1381-1383.
- Schoeninger MJ**, DeNiro MJ (1984) "Nitrogen and Carbon Isotopic Composition of Bone Collagen from Marine and Terrestrial Animals." *Geochimica et Cosmochimica Acta* 48: 625-639.
- Schoeninger MJ**, Moore KM, Murray ML, Kingston JD (1989) "Detection of bone preservation in archaeological and fossil samples." *Applied Geochemistry* 4: 281-292.
- Schwarcz HP**, Schoeninger MJ (1991) "Stable Isotope Analyses in Human Nutritional Ecology." *Yearbook of Physical Anthropology* 34: 283-321.
- Schwartz GM**, Curvers HH, Dunham SS, Stuart B, Weber JA (2006) "A Third-Millennium B.C. Elite Mortuary Complex at Umm el-Marra, Syria: 2002 and 2004 Excavations." *American Journal of Archaeology* 110 (No. 4): 603-641.
- Schwartz M**, Hollander D (2008) "Bulk stable carbon and deuterium isotope analyses of bitumen artifacts from Hacinebi Tepe, Turkey: reconstructing broad economic patterns of the Uruk expansion." *Journal of Archaeological Science* 35: 3144-3158.

Sertok K, Ergeç R (1999) "A New Early Bronze Age Cemetery: Excavations Near the Birecik Dam, Southeastern Turkey. Preliminary Report (1997-98)." *Anatolica* 225: 87-107.

Sconzo P (2007) "Plain and Luxury Wares of the Third Millennium BC in the Carchemish Region: Two Case-Studies from Tell Shiyukh Tahtani." In: Peltenburg E [ed.] *Euphrates River Valley Settlement: The Carchemish Sector in the Third Millennium BC*. Oxbow Books, Oxford: 250-266.

Sealy JC, van der Merve NJ, Lee-Thorp JA, Lanham JL (1987) "Nitrogen isotopic ecology in southern Africa: Implications for environmental and dietary tracing." *Geochimica et Cosmochimica Acta* 51: 2707-2717.

Service ER (1962) *Primitive Social Organization*. Random House, Inc., New York.

Sewell WH (2005) *Logics of History*. The University of Chicago Press, Chicago and London.

Sharma S, Joachimski MM, Tobschall HJ, Singh IB, Tewari DP, Tewari R (2004) "Oxygen isotopes of bovid teeth as archives of paleoclimatic variations in archaeological deposits of the Ganga plain, India." *Quaternary Research* 62: 19-28.

Sherratt A (1981) "Plough and Pastoralism: Aspects of the Secondary Products Revolution." In: Hodder I, Isaac G, Hammond N [eds.] *Pattern of the Past: Studies in Honour of David Clarke, 1981*. Cambridge University Press, Cambridge: 261-305.

Sherratt A (1999) "Cash-crops Before Cash: Organic Consumables and Trade." In: Gosden C, Hather JG [eds.] *The Prehistory of Food: Appetites for Change*. Routledge, New York: 13-34.

Shirley RL (1985) "Water Requirements for Grazing Ruminants and Water as a Source of Minerals." In: McDowell LR [ed.] *Nutrition of Grazing Ruminants in Warm Climates*. Academic Press, Inc., Orlando (FL): 37-58.

Siracusano G (2014) "Third Millennium BC Fauna at Tell Beydar." In: Milano L, LeBeau M [eds.] *Tell Beydar: Environmental and Technical Studies (Volume II)*. Brepols Publishers, Turnhout, Belgium: 271-304.

Sklair L (2000) *The Transnational Capitalist Class*. Wiley-Blackwell, Oxford.

Slater LE (1981) "Dimensions of the World Food and Climate Problem." In: Bach W, Pankrath J, Schneider SH [eds.] *Food-Climate Interactions*. D. Reidel Publishing Company, Dordrecht & Boston: 21-46.

- Spengler O** (1923) *Der Untergang des Abendlandes (The Decline of the West)*. C.H. Beck, Munich.
- Staubwasser M, Weiss H** (2006) “Holocene climate and cultural evolution in late prehistoric-early historic West Asia.” *Quaternary Research* 66: 372-387.
- Stein GJ** (1988) “Pastoral Production in Complex Societies: Mid-Late Third Millennium B.C. and Medieval Faunal Remains from Gritille Höyük in the Karababa Basin, Southeast Turkey.” *Unpublished Doctoral Dissertation*.
- Stevens LR, Ito E, Schwalb A, Wright Jr. HE** (2006) “Timing of atmospheric precipitation in the Zagros Mountains inferred from a multi-proxy record from Lake Mirabad, Iran.” *Quaternary Research* 66: 494-500.
- Steward JH** (1955) *Theory of Culture Change: The Methodology of Multilinear Evolution*. University of Illinois Press, Champaign-Urbana (IL).
- Stork L** (2014) “On pins and needles: understanding the role of metal pins in the Upper Euphrates Valley during the Early Bronze I–II.” *Levant* 46 (No. 3): 321-338.
- Struve VV** (1969) “The Problem of the Genesis, Development, and Disintegration of the Slave Societies in the Ancient Orient.” In: Diakonoff IM [ed.] *Ancient Mesopotamia: Socio-Economic History*. Nauka Publishing House, Moscow: 17-69.
- Tainter JA** (1988) *The Collapse of Complex Societies*. Cambridge University Press (New Studies in Archaeology Series), Cambridge and New York.
- Tainter JA** (2006) “Archaeology of Overshoot and Collapse.” *Annual Review of Anthropology* 35: 59-74.
- Tilley CY** (1994) *A Phenomenology of Landscape: Places, Paths and Monuments*. Berg, London.
- Tonkov S, Bozilova E, Marinova E, Jünger H** (2008): “History of vegetation and landscape during the last 4000 years in the area of Straldzha mire (SE Bulgaria).” *Phytologia Balcanica* 14 (No. 2): 185–191.
- Trella PA** (2010) *Evaluating Collapse: The Disintegration of Urban-Based Polities in Third Millennium B.C. Upper Mesopotamia*. *Unpublished Doctoral Dissertation*.
- Triantaphyllou MV, Ziveri P, Gogou A, Marino G, Lykousis V, Bouloubassi I, Emeis K-C, Kouli K, Dimiza M, Rosell-Melé A, Papanikolaou M, Katsouras G, Nunez N** (2009) “Late Glacial–Holocene climate variability at the south-eastern margin of the Aegean Sea.” *Marine Geology* 266: 182-197.

Trigger BG (2006) *A History of Archaeological Thought*. Cambridge University Press, Cambridge and New York.

Türkeş M (1996) “Meteorological Drought in Turkey: A Historical Perspective, 1930—93.” *Drought Network News (1994-2001)*. Paper 84. Online: <http://digitalcommons.unl.edu/droughtnetnews/84>

Türkeş M (1998) “Influence of Geopotential Heights, Cyclone Frequency and Southern Oscillation on Rainfall Variations in Turkey.” *International Journal of Climatology* 18: 649-680.

Ülgen UB, Franz SO, Biltekin D, Çagatay MN, Roeser PA, Doner L, Thein J (2012) “Climatic and environmental evolution of Lake Iznik (NW Turkey) over the last ~4700 years.” *Quaternary International* 274: 88-101.

Ulu M, Karahanoglu N(1998) “Characterization of the Karababa-C reservoir in the South Karakuş oil field, Southeast Turkey.” *Marine and Petroleum Geology* 15: 803-820.

Ur JA (2010) *Urbanism and Cultural Landscapes in Northeastern Syria: The Tell Hamoukar Survey 1999-2001*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Ur JA (2011) “Ancient Landscapes in Southeastern Anatolia.” In: Steadman SR, McMahon G [eds.] *The Oxford Handbook of Ancient Anatolia*. Oxford University Press, Oxford and New York: 836-857.

Ur JA, Hammer E (2009) “Pastoral Nomads of the 2nd and 3rd Millennia A.D. on the Upper Tigris River, Turkey: The Hirbemerdon Tepe Survey.” *Journal of Field Archaeology* 34: 37-56.

Van der Leeuw SE, Aschan-Leygonie C (2000) *A Long-Term Perspective on Resilience in Socio-natural Systems*. Santa Fe Institute Press (SFI Working Paper), Santa Fe, NM.

Van der Leeuw SE, Redman CL (2002) “Placing Archaeology at the Center of Socio-Natural Studies.” *American Antiquity* 67 (No. 4): 597-605.

Van Loon MN, Meijer DJW (1988) “Conclusions.” In: Van Loon MN [ed.] *Hammam et-Turkman I: Report on the University of Amsterdam’s 1981-84 Excavations in Syria*. Nederlands Historisch-Archaeologisch Instituut te Istanbul, Istanbul: 697-702.

Van der Plicht J, Akkermans PMMG, Buitenhuis H, Kaneda A Nieuwenhuys O, Russell A (2012) "Tell Sabi Abyad, Syria: An Interpretation of Stable isotope Values of Faunal Bone Collagen." *Radiocarbon* 54 (No. 3-4): 281-289.

Visicato G (2000) *The Power and the Writing: The Early Scribes of Mesopotamia*. CDL Press, Bethesda (MD).

Voigt MM, Ellis RS (1981) "Excavations at Gritille, Turkey : 1981." *Paléorient* 7 (No. 2): 87-100.

Wagner B, Lotter AF, Nowaczyk N, Reed JM, Schwalb A, Sulpizio R, Valsecchi V, Wessels M, Zancheta G (2009) "A 40,000-year record of environmental change from ancient Lake Ohrid (Albania and Macedonia)." *Journal of Paleolimnology* 41: 407-430.

Wattenmaker P (1998) *Household and State in Upper Mesopotamia: Specialized Economy and the Social Uses of Goods in an Early Complex Society*. Smithsonian Institution Press, Washington D.C. and London.

Webb JM, Frankel D, Stos ZA, Gale N (2006) "Early Bronze Age Metal Trade in the Eastern Mediterranean: New Compositional and Lead Isotope Evidence From Cyprus." *Oxford Journal of Archaeology* 25 (No. 3): 261-288.

Weiberg E (2012) "What can Resilience Theory do for (Aegean) Archaeology?" In: Burström NM, Fahlander F [eds.] *Matters of scale: Processes and courses of events in archaeology and cultural history*. Stockholm University Press, Stockholm: 146-165.

Weiss H (1983) "Excavations at Tell Leilan and the Origins of North Mesopotamian cities in the Third Millennium B.C." *Paléorient* 9 (No. 2): 39-52.

Weiss H (2000) "Beyond the Younger Dryas: Collapse as Adaptation to Abrupt Climate Change in Ancient West Asia and the Eastern Mediterranean." In: Bawden G, Reycraft RM [eds]: *Environmental Disaster and the Archaeology of Human Response*. Maxwell Museum of Anthropology, University of New Mexico, Albuquerque: 75-98.

Weiss H, Courty M-A, Wetterstrom W, Guichard F, Senior L, Meadow R, Curnow A (1993) "The Genesis and Collapse of Third Millennium North Mesopotamian Civilization." *Science* (New Series) 261 (No. 5124): 995-1004.

Welton L (2014) "Revisiting the Amuq sequence: a preliminary investigation of the EBIVB ceramic assemblage from Tell Tayinat." *Levant* 46 (No. 3): 339-370.

Westaway R, Demir T, Seyrek A (2008) “Geometry of the Turkey-Arabia and Africa-Arabia plate boundaries in the latest Miocene to Mid-Pliocene: the role of the Malatya-Ovacık Fault Zone in eastern Turkey.” *Earth* 3: 27- 35.

White CD, Spence MW, Longstaffe FJ, Law KR (2000) “Testing the Nature of Teotihuacán Imperialism at Kaminaljuyú Using Phosphate Oxygen-Isotope Ratios.” *Journal of Anthropological Research* 56 (No. 4): 535-558.

Wick L, Lemcke G, Sturm M (2003) “Evidence of Lateglacial and Holocene climatic change and human impact in eastern Anatolia: high-resolution pollen, charcoal, isotopic and geochemical records from the laminated sediments of Lake Van, Turkey.” *The Holocene* 13 (No. 5): 665-675.

Wiener MH (2013) “‘Minding the Gap’: Gaps, Destructions, and Migrations in the Early Bronze Age Aegean: Causes and Consequences.” *American Journal of Archaeology* 117 (No. 1): 581-592.

Wilkinson TJ (1990) *Town and Country in Southeastern Anatolia. Volume I: Settlement and Land Use at Kurban Höyük and Other Sites in the Lower Karababa Basin*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Wilkinson TJ (1994) “The Structure and Dynamics of Dry-Farming States in Upper Mesopotamia.” *Current Anthropology* 35 (No. 5): 483-520.

Wilkinson TJ (1998) “Water and Human Settlement in the Balikh Valley, Syria: Investigations from 1992-1995.” *Journal of Field Archaeology* 25 (No. 1): 63-87.

Wilkinson TJ (2000) “Settlement and Land Use in the Zone of Uncertainty in Upper Mesopotamia.” In: Jas RM [ed.] *Rainfall and Agriculture in Northern Mesopotamia*. Nederlands Instituut voor het Nabije Oosten, Leiden: 1- 36.

Wilkinson TJ (2004) *On the Margin of the Euphrates: Settlement and Land Use at Tell es-Sweyhat and in the Upper Lake Assad Area, Syria*. Oriental Institute Publications, The Oriental Institute of the University of Chicago, Chicago (IL).

Wilkinson TJ (2007) “Archaeological regions in the neighbourhood of Carchemish.” In: Peltenburg E [ed.] *Euphrates River Valley Settlement: The Carchemish Sector in the Third Millennium BC*. Oxbow Books, Oxford: 27-42.

Winch D (2013) *Malthus: A Very Short Introduction*. Oxford University Press, Oxford and New York.

Wolff and Goldberg 2008, *Unpublished Report*.

Wright LE, Schwarcz HP (1996) “Infrared and Isotopic Evidence for Diagenesis of Bone Apatite at Dos Pilas, Guatemala: Palaeodietary Implications.” *Journal of Archaeological Science* 23: 933–944.

Wright LE, Schwarcz HP (1998) “Stable Carbon and Oxygen Isotopes in Human Tooth Enamel: Identifying Breastfeeding and Weaning in Prehistory.” *American Journal of Physical Anthropology* 106 1-18.

Wright LE, Schwarcz HP (1999) “Correspondence Between Stable Carbon, Oxygen and Nitrogen Isotopes in Human Tooth Enamel and Dentine: Infant Diets at Kaminaljuyu.” *Journal of Archaeological Science* 26: 1159-1170.

Yener KA, Vanidver PB (1993) “Tin Processing at Göltepe, an Early Bronze Age Site in Anatolia.” *American Journal of Archaeology* 97 (No. 2): 207-238.