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Who was eating fish at kish? : a theoretical framework for using stable isotope analysis to explore processes of political economy in early dynastic Mesopotamia

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Who Was Eating Fish at Kish? A Theoretical Framework for Using Stable Isotope Analysis to Explore Processes of Political Economy in Early Dynastic Mesopotamia

A Thesis submitted in partial satisfaction of the requirements

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in

Anthropology

by

Adam William Schneider

Committee in Charge:

Professor Guillermo Algaze, Chair
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Professor Thomas Levy

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The Thesis of Adam William Schneider is approved, and is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

2010

DEDICATION

I dedicate this work to my father, Stephen, whose exemplary academic career has been both an incalculable influence on me throughout my life, and a model for my own academic pursuits; and my mother, Cheryl, whose keen interest in archaeology has matched - if not exceeded - my own for many years. I very much doubt that I would be where I am today without you, and I remain forever indebted to you both for your tireless support and assistance.

TABLE OF CONTENTS

LIST OF FIGURES

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ABSTRACT OF THE THESIS

Who Was Eating Fish at Kish? A Theoretical Framework for Using Stable Isotope Analysis to Explore Processes of Political Economy in Early Dynastic Mesopotamia

by

Adam William Schneider

Master of Arts in Anthropology

University of California, San Diego 2010

Professor Guillermo Algaze, Chair

Archaeology in Mesopotamia has a long history, with over a century of fieldwork having been undertaken to better understand this important region. The present work discusses the opening of a new chapter in Mesopotamian archaeology: the introduction of paleodiet reconstruction through the analysis of stable isotopes in human skeletal materials. To date, little, if any published research has ever been done that utilizes this method in the study of Mesopotamia, which is particularly unfortunate in light of the fact that stable isotope analysis has been an important and successful means of acquiring valuable information about other ancient societies.

In this paper, I will briefly sketch several areas of study in the archaeology of Mesopotamia during the Third Millennium BCE, wherein the application of paleodiet reconstruction might be particularly illuminating, and could effectively supplement existing archaeological and linguistic data to further our understanding of a number of social, economic, and political processes that took place during that period. I will address the prospects for stable isotope analysis in relation to long-distance exchange of perishable commodities and elite self-aggrandizement through feasting. I will show in this assessment that, while there are very real political and practical hindrances that must be surmounted to achieve successful results with this technique, there is every reason to believe that these obstacles can be navigated successfully, and that the inclusion of stable isotope analysis in Mesopotamian archaeological study can only be of great benefit of the archaeological community as a whole.

Chapter 1. Introductory Remarks

Archaeology, as a discipline, has long been employed as a means to better understand the origins and evolving nature of human society. Questions of great relevance to understanding the human story, such as the colonization of the New World, the rise of urban complex societies across the globe, and the independent developments of agriculture, art, ritual, technology and writing have all been addressed by the process of archaeological inquiry.

There is perhaps nowhere on the planet which has yielded a greater hoard of data about the human past than the lands which we today call the Near East. This region has provided scholars with some of the earliest evidence of agriculture, urbanism, and complex sociopolitical organization yet found. Indeed, the Fertile Crescent boasts an impressive record of "firsts" in human prehistory, including the earliest known state-level societies (Postgate 1992: *xxi*) and the oldest known writing system (Schmandt-Besserat 2007).

Moreover, some of the greatest triumphs of archaeology have taken place in Mesopotamia. The treasures recovered during excavations during the first half of the 20th century, such as those of Sir Leonard Woolley at Ur, have captured the imagination of the world by exposing for the first time in millennia a glimpse of the dynamism and resourcefulness that characterized the ancient peoples of the region. It was largely out of the study of Mesopotamia, too, that V. Gordon Childe formulated his theories of the agricultural and urban revolutions (Childe 1936; 1950), which have influenced archaeology far beyond the Near East (e.g., Balkansky et al 2004). It seems fair to say, then, that the lands which we call Mesopotamia not only justifiably bear the moniker the “cradle of civilization”, but that they also can be known, along with Egypt, the Aegean, and a handful of other culture areas, as a place where archaeology first cut its teeth as a social science.

Given these advantages, it is little wonder that the archaeology of Mesopotamia has historically been at or near the forefront of the larger discipline. Sadly, in recent years, political, ethnic, and religious strife has made much of the region largely or completely inaccessible to archaeologists. Nearly thirty years of warfare, interrupted only by brief periods of relative calm, have impeded new efforts of exploration and excavation, particularly in the alluvial plain itself. (One happy consequence of this turmoil has been an increasing interest in “peripheral” areas of ancient Mesopotamia, mainly in Syria and southeastern Turkey, which have been relatively unscathed by the difficult and violent political transition that is still unfolding in the shadows of Ur and Babylon.) Largely as a result of recent decades of turmoil, many important questions in Mesopotamian archaeology remain only partly investigated. Furthermore, a number of new and exciting archaeological techniques have not yet been employed in the study of the region.

This paper will consider the prospects of a relatively new method of archaeological inquiry which has not been applied in the study of ancient Mesopotamia: the reconstruction of human and animal paleodiet through analysis of carbon and nitrogen stable isotopes in bone collagen. The analysis of stable isotopes for this purpose has been a successful part of archaeological investigation in many other parts of the world, where it has been used to ascertain important new information about human dietary habits, and related social, economic, and political aspects of life in the past for several decades. Thus far, paleodiet reconstructions along these lines remain a method that has been virtually unknown in Mesopotamian archaeology.

There are good reasons for archaeologists studying the prehistory and/or ancient history of the region to seriously consider introducing this method of analysis into their research. Paleodiet reconstructions based on stable isotope data have been incorporated into a diverse range of investigations concerning important archaeological issues, which include the adoption of agriculture (e.g. Hutchinson et al 1998; e.g. Hu et al 2008), gender relations (e.g. White 2005), socioeconomic status differentiation (e.g. Ambrose et al 2003), interactions of economic and ritual activities (e.g. Somerville et al 2009; *in press*), and the effects of state or imperial hegemonic practices (e.g. Kellner and Schoeninger 2008).

Paleodiet reconstruction could be employed to further explore some important questions in Mesopotamian archaeology that have proven difficult to probe through traditional archaeological methods. Of these, processes of commercial production and exchange, in particular, have been frustratingly hard to demonstrate archaeologically. The lack of material evidence has subsequently forced archaeologists to rely primarily on textual information recovered in the form of clay tablets. While much has been learned about the region's early history through the study of these documents, a certain overreliance on interpretations of texts that are often incomplete and difficult to translate is problematic. Additionally, in light of the fact that much of the alluvial floodplain is currently closed to fieldwork, a number of issues which remain unresolved by textual interpretation have been impossible to corroborate with new information recovered from the field.

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 originating from this practice (see Hawkins 1983 [*review*]). Conflicting interpretations of the linguistic and idiomatic meanings of passages - or even of individual words - make it difficult to attain a consensus understanding of what archaeologically-important information may be gleaned from these archives. 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*]).

There is already awareness among Mesopotamian archaeologists about the need for multiple forms of archaeological data to better our understanding of the region. Robert McC. Adams summarizes the value of material evidence thusly:

> It will be a primary responsibility of future archaeologists, not Assyriologists, to discover the real scale as well as the details of these more differentiated patterns of socio-economic life, of which

> only hints will have found their way into cuneiform texts through the myopic view of ancient scribes of their own hinterland. (Adams 2007: 3)

In this passage, Adams has laid bare another problem that arises from relying too much on the written record - texts only impart information from the perspective of those who wrote down said information in the first place. Most of the tablets that have been recovered from Third Millennium BCE contexts are administrative records of local managerial and economic activity (see Foster 1982), although smaller numbers of lexical texts, or more rarely, religious or political documents (such as mythological epics or legal texts) have also been recovered. It is safe to suppose that, because literacy in Early Dynastic Mesopotamia was not widespread, these documents are probably not representative of the perspectives of ordinary citizens. More likely, they expose only the views of the elites who exercised political, economic, or ideological control over archaic cities and/or states, or those of the scribes whom those elites employed as record-keepers and administrators.

It is crucial to supplement these accounts with other lines of investigation, as the information which such documents convey must be continually checked against the archaeological record for inconsistencies that must, when found, be explained as carefully and completely as is possible. Paleodiet reconstructions based on the analysis of stable isotopies have the advantage of being objectively tested by laboratories which follow strict procedures to ensure a high degree of accuracy. These isotopic data must still be interpreted, but the subjectivity of interpretation is mitigated by the fact that an analysis may be replicated, so long as enough sampled material remains for future study.

Not only is there ample reason to introduce this type of analysis into Mesopotamian archaeology, then, but there are also known archaeological resources from which isotopic data might be obtained. A few collections of Mesopotamian skeletal remains have been removed from the Near East, which therefore present fewer challenges to access for potential study. From Mesopotamia proper[1], two sites, in particular, have yielded a number of burials that are now in western museums: Kish (see Algaze 1986; Rathbun 1975), and Ur (Molleson and Hodgson 2003). It is the existence of such skeletal collections that makes possible a serious discussion of the prospects for the study of those burials through stable isotope analysis.

The present work is submitted as an assessment of the prospects of stable carbon and nitrogen isotope analysis in the study of Mesopotamian archaeology. Here, the discussion of stable isotope analysis in Mesopotamia will be limited to a span of time known as the the Early Dynastic period, which covers most of the Third MIllennium BCE, or approximately 2800-2300 BCE. Specifically, the uses of isotopic analysis for the investigation of Early Dynastic political economy will be discussed, with an emphasis on the production, exchange, and consumption of commodities. The discussion will be partitioned into four sections. In this first section, important theoretical points will be

[1] From peripheral centers to the north and east of the alluvium, a larger number of cemetery or mortuary contexts have been excavated, and skeletal remains obtained (see Schwartz et al 2006; Sertok and Ergeç 1999)

discussed - including the definitions of some key terms - followed by a brief sketch of current archaeological perspectives on the political economy of ancient Mesopotamian states. The principles of isotopic analysis will be explained in Section Two. The third segment is devoted to the existing archaeological data in Mesopotamia regarding the role of aquatic and marine foods in two processes: the long-distance exchange of so-called "invisible exports" (Crawford 1973); and self-aggrandizing consumption of prestige foods by social elites. In the fourth section, some hypothetical benchmark isotope values are proposed, and the implications of isotope studies in the study of Mesopotamian political economy will be explored. Finally, in the concluding section, uses for isotopic analysis in considering other theoretical areas of interest - such as the production of ethnic identity or the institutionalization of ancient gender bias - will be briefly sketched, and the overall prospects for isotope analysis in Mesopotamian archaeology will be addressed.

Theory, Definitions, and Historical Background

For the sake of clarity and of accuracy, I pause here to define a number of terms which will appear in this paper that might otherwise cause confusion. I begin with a brief explanation of my geographical terminology (see also fig. 1), with specific reference to the regional designations *Mesopotamia*, *Sumer*, *Babylonia*, *Assyria*, and *Syria*. Mesopotamia will here denote the alluvial culture area in its broadest sense; this usage follows Norman Yoffee's notion of a shared "Mesopotamianness" that can be seen archaeologically throughout the alluvium (Yoffee 1995: 291). The geographical extent of Mesopotamia, then, is that in which important shared cultural features are present, including similar forms of agricultural practice; political organization; religious ideologies; artistic style; and the adoption of cuneiform script. Thus, here the term Mesopotamia includes not only the lands between the Tigris and Euphrates rivers, but also extends northward into the Iraqi Jazirah, and eastward into the Diyala drainage.

Having described the larger territorial setting, more specific geographical-cultural designations for *Babylonia*, *Sumer*, and *Assyria* will next be addressed. These terms, like Mesopotamia, will demarcate areas of common cultural traits, but in terms of difference, rather than sameness. Thus, while many scholars refer to the region of *Babylonia* as the whole of the southern and central alluvial floodplain between the Tigris and Euphrates rivers, including the Sumerian-speaking area (e.g., Postgate 1992: 36), *Babylonia* will here be defined as the zone of Semitic-speaking peoples in the central portion of the alluvial plain, whose principal cities included Kish and Abu Salabikh. North and east of this region is *Assyria* (*ibid*), in which the cities of Aššur and Nineveh were located. *Sumer*, then, refers only to the the southern alluvial plain, in which important Sumerian-speaking polities such as Uruk, Ur, and Lagaš developed.

The three alluvial zones are kept separate from *Syria* to the west. Syria includes not only cities located in the modern nation of that name, but also the urban centers of southeastern Anatolia. (Although the majority of analysis in the present work will pertain specifically to events in southern Mesopotamia (that is, in Sumer and Babylonia), some limited discussion of Early Dynastic Syria will also be incorporated into the larger study.) It should be noted that these distinctions are not meant to imply some kind of total cultural segregation of Syria from the rest of Mesopotamia. Rather, the distinctions of geography here are intended to highlight distinct patterns of regional culture within the ancient Near East, which can be examined via stable isotope analysis.

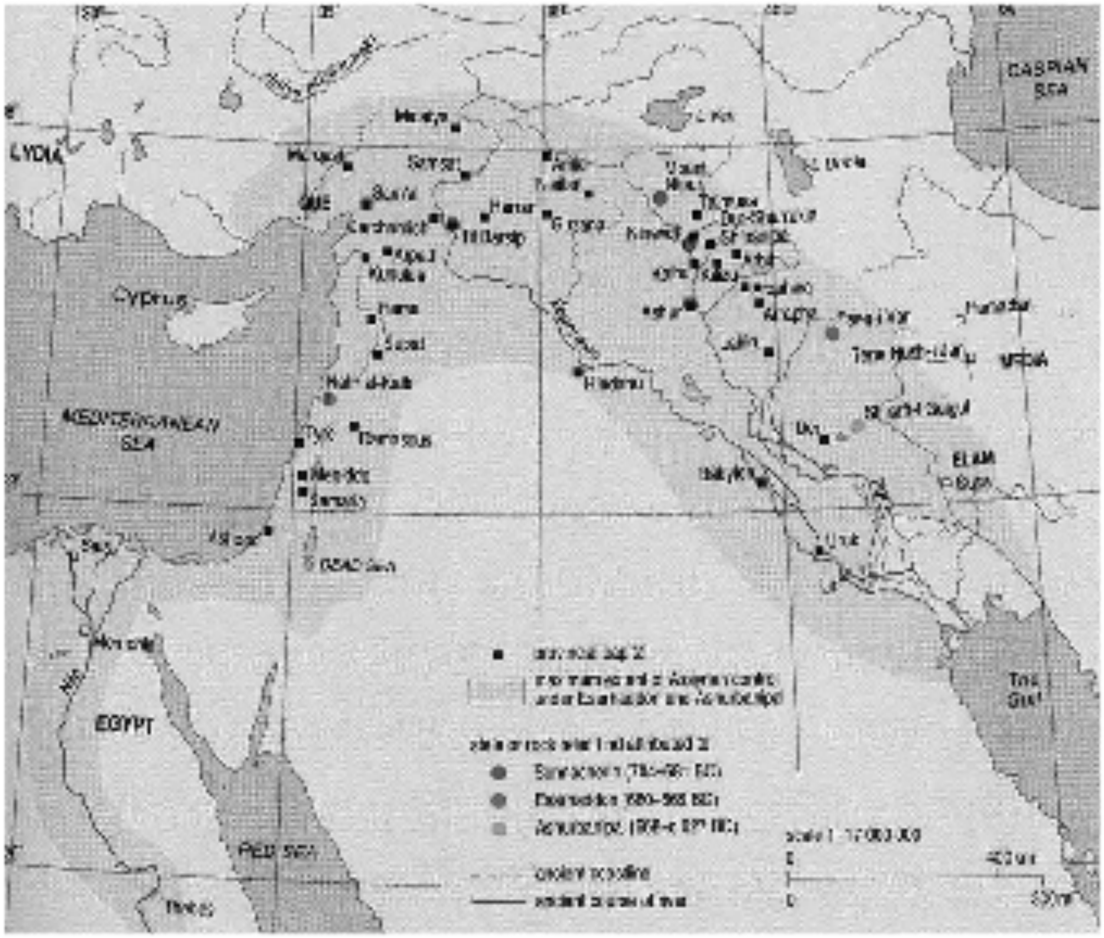

Fig. 1: Map of the Ancient Near East (taken from Bahrani 2006).

Having thus defined the geographical setting for this discussion, I define here the nature and role of the state, as states during the Early Dynastic period were the primary economic and political forces interacting within the lands described above. Much has been said about the nature and development of states in the corpus of archaeological literature, and a number of definitions for this class of sociopolitical organization have been proposed over the years. Such definitions range from Marxist interpretations that consider social inequality to have been both the catalyst and *raison d'être* of the state (e.g. Tosi 1975;

Wallerstein 1975); to evolutionary “trait lists” of certain key features that are common to all states (Fried 1967; Service 1975); to proposals that the state arose out of need for managerial direction of large-scale logistical and economic problems (Wittfogel 1957); to ecologically-grounded models which describe states as a complex system of interactions between humans and their technoenvironment (Brumfiel 1983). While taking note of Norman Yoffee’s point that too many definitions of the state have made the incorrect assumption that states are monolithic institutions that lack diversity of form, or of function (see Yoffee 2005: ch. 1), it remains necessary to nevertheless offer a few words about what the term *state* shall describe in this assessment.

While there is no single definition that can adequately describe all of the characteristics and functions of a state, I consider the view put forth by Melinda Zeder in her 1991 book *Feeding Cities* to be particularly suitable for describing that sociopolitical form in ancient Mesopotamia. Zeder says that “the state cannot [...] be viewed as a central governance, stratified society, or specialized economy, but as the result of the interaction of all of these features” (Zeder 1991: 17), and this seems to me a useful way of contextualizing Mesopotamian states - including city-states - as the principal actors in a complex system of economic interaction. Zeder explains her rejection of what could be called a “universal trait list model” for states with the following observation:

> Each state, ancient and modern, is, then, a unique expression of these basic underlying factors. No single path of state development can be applied to the study of all states. Yet to say that each trajectory of state development is unique, is not to say that there can only be particularistic explanations for each instance

> of state emergence. For while there are particular explanations for each instance of state emergence, all of these explanations should make reference to the more abstract processes that trigger the development of specialized hierarchical organizations in any or all of these central political, economic, or social spheres. (Zeder 1991: 18)

Her observation is especially relevant for the study of a culture area like Mesopotamia, which features a number of polities which have traditionally been called “city-states” that would not necessarily qualify as state-level societies in evolutionary models.

During a politically-decentralized phase like the Early Dynastic period, the political and economic situation of Mesopotamia was probably more or less heterarchical, with competition and coordination, rather than direct territorial control, forming the basis of commercial and political interaction in the region (Pollock 1999: 9). The reason that a universal trait list-based conception of statehood for Early Dynastic Mesopotamia is so problematic is that the region was in the midst of a period of relative political disintegration, making the identification of a clear example of a territorial state difficult, if not impossible. Would economically powerful cities in Sumer, such as Ur or Lagaš, qualify as states? Similarly, Kish held a position of great prestige and political importance, but given its limited territorial extent[2], can the city really be defined as a “state”, as described by trait list models? And what of Ebla or Mari, in Syria, whose territorial and political extent remain disputed? Indeed, even Joyce Marcus, who has called for the outright elimination of the “city-state” in archaeology (viewing it

[2] This excludes the interpretation of a wider “Kish civilization”, as described by Gelb (see below).

instead as a vestigial remnant of earlier state formations; see Smith and Schreiber 2006: 7), has also noted that the term seems misleading when applied to Mesopotamian polities (Marcus 1998: 81).

Leaving aside the larger question of whether or not the "city-state" should be removed from archaeology as a whole, it seems clear that a universalized conception of the state is not conducive to a nuanced reading of what comprises that political form, and is therefore less useful in a region like Mesopotamia, where commercial power and political prestige were at least as important as territorial hegemony. The centralization of political power and economic resources by a political and social elite in Mesopotamian cities, which was backed by a large administrative bureaucracy, also tallies with the trait list description of states better than that of other forms of sociopolitical organization, such as chiefdoms. In other words, for Mesopotamia, the notion that no polity which lacks a certain arbitrary level of population or sufficient degree of settlement hierarchy can be considered a state (in terms of its social complexity) makes little sense. Thus, it seems to me that we are better served considering the state in this regional context in terms of its *combination* of function and form, rather than by its form alone. Here, then, a state in Mesopotamia will be defined as any independent polity which governs the central economic, social, and political processes that take place within its territory towards its own furtherance.

The policies enacted by Early Dynastic Mesopotamian states to fulfill their economic, social, and political aims fall under the broad category of *political economy*. Here, political economy will be defined as a set of strategies implemented by a state to produce, manage, distribute or exchange economic resources towards the maintenance and expansion of its political and economic power. These strategies may be short- or long-term in duration, and often involve the coordination of concomitant political and economic actions. Examples of such strategies can include, for instance, the establishment of long-term colonial ventures designed to extract otherwise unobtainable resources; the decision of a polity to increase its agricultural productivity by seizing fertile land from neighboring groups; or the acquisition and display of socially prestigious materials to bolster the political position of social elites.

Political economy has been a subject of archaeological comment since the early 1950s, when Karl Polanyi first described the articulation of political and economic processes in early societies (Polanyi 1957). Political economy has become a mainstay in archaeology in the intervening decades, and various forms of political economy have been described in archaeological contexts all over the world (e.g., Algaze 1993; Earle 2002). Some of this discussion has focused on chiefdom-level polities, as these are widely thought to represent a transition stage between egalitarian societies and full-fledged states (for an in-depth discussion of chiefdom political economies, see Earle 2002); however, in this analysis, the discussion will focus exclusively on state-level polities.

Political economy is also studied at a regional level, through the political and economic interactions of states or other political entities. A number of archaeological models have been proposed as prototypes for regional patterns of interstate political and economic activity. These include the peer-polity interaction model (Renfrew 1986); other interregional interaction models (Stein 2002); and a number of regional core-periphery models which are at least partly based on Immanuel Wallerstein's world systems theory (e.g. Algaze 1993; Ekholm and Friedman 1979; Santley and Alexander 1992).

Much of the discussion of political economy in the Mesopotamia has been focused on the origins of complex sociopolitical organization, and the importance of various political or economic processes in bringing about this evolution. In particular, the origins of so-called "pristine states" in the region is a matter of much debate. Robert McC. Adams has shown that, even at the level of local subsistence farming, "the nuclear family is not a viable defensive, productive, and managerial unit" (Adams et al 1974: 4), and that complex tasks such as digging irrigation canals required more centralized management. This is also the view taken by Henry Wright and Gregory Johnson, who have concluded that Mesopotamian states arose out of a need for "the total organization of decision-making activities" that led to a unified administrative structure which became the basis of state-level political organization (Wright and Johnson 1975: 267).

However, at least in the study of Early Dynastic Mesopotamia, to talk of political economy is also to talk of state activity. By the latter half of the Third Millennium BCE, urban centers were the predominant areas of human population, and city-states the primary form of sociopolitical organization (Pollock 1999: 72-73). As a result, all activities related to political economy became, to varying degrees, the province of states. Examples of state political-economic activities that have received scholarly comment include: the development of complex irrigation systems to further agricultural production (Wittfogel 1957); long-distance commercial exchange (e.g., Crawford 1973; Lamberg-Karlovsky 1972; Postgate 1979); the implementation of administrative schemes of economic redistribution, including rationing (Hunt 1991; Visicato 2000); and the development of a scribal bureaucratic system to monitor, record, and manage urban economic output (e.g., Foster 1982; Visicato 2000).

The Early Dynastic period can also be characterized by intense economic competition and political rivalry among city-states (which resulted in the formation of political and economic alliances between polities; see Ekholm and Friedman 1979; Postgate 1992: chs. 8-9). Whatever their form, interstate relationships of Early Dynastic Mesopotamia were abruptly and dramatically altered by the sudden ascendancy of the city of Akkad (or Agade/Akkade), which conquered most of the Fertile Crescent under its first ruler, Sargon[3]. The Akkadian Dynasty that resulted was one of direct imperial administration over all Akkadian dependencies, which took the form of dendritic political economy (see Santley and Alexander 1992: 26-27), where tribute and commerce all flowed directly to Akkad before being distributed elsewhere (Foster 1977). Eventually, after approximately 150 years, the Akkadians were overthrown by the Guti, a tribe from somewhere east of the Tigris, and after a brief period of Gutian rule (known sometimes as the “Gutian Interlude”), political power and economic preeminence

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[3] The Akkadian grip on conquered territories, however, was never firm, as historical accounts attest in reports of multiple reconquests of the frontier by Sargon’s successors - as well as occasional but significant rebellion staged by economically- and politically-important Sumerian and Babylonian cities (Postgate 1992: 40-41).

at the end of the millennium was concentrated for a further century at Ur, a period which is designated the Ur III Dynasty.

It is within the varied and changing political and economic context of the Third Millennium BCE that the prospects for the investigation of political economy through stable isotope analysis will be assessed. I will show in this study that isotopic analysis has great potential to be a valuable means of exploring topics of anthropological interest to which the method has not yet been widely applied, such as political economy. Certainly, there are isotope studies which identify patterns of dietary consumption in past societies (e.g., Craig et al 2009; Harrison and Katzenberg 2003; Tafuri et al 2009), and have isolated differentiations in diet between social classes (e.g., Price et al 2009), sex-based discriminatory practices as seen through diet (e.g., Ambrose et al 2003; White 2005), or even the influence of political change upon ancient dietary habits (e.g., Kellner and Schoeninger 2008); yet very few have explicated state strategies for economic production or commodity exchange (e.g., Somerville et al 2009). Ancient Mesopotamia, which has yielded a corpus of administrative records describing a diversity of economic and political behaviors, seems an ideal environment in which to assess the possibilities for expanding the scope of isotopic analysis into this field, because the region's rich historical record, and significant body of material evidence, can be readily supplemented with stable isotope data.

Here, the uses of isotope analysis in archaeological investigations of ancient political economy will be focused on a number of logistical, administrative or social problems faced by Early Dynastic states, or strategies implemented to solve problems. The topics which will be discussed herein are the trade in so-called "invisible exports" (Crawford 1973) and the acquisition of important prestige foods for consumption and display by social elites. Both of these processes will be explored through the medium of aquatic and marine food resources to illustrate how isotopic data can be used to supplement the current understanding of Near Eastern political and economic behavior, or to provide a starting point for future inquiries where other data are not available.

Unfortunately, present-day political turmoil in the Near East presents a number of hindrances for archaeological endeavor in the region, which will likely challenge any efforts in this field for the near-term future. While some of these problems are common to all archaeological projects being carried out in the Near East, a number of other concerns need to be accounted for in relation to this specific area of inquiry. For instance, the need to acquire samples taken from human skeletal materials can sometimes require that a number of legal and bureaucratic processes be successfully navigated before research can begin. Such efforts may be further complicated if the researchers should need to export samples, or any other human skeletal materials, from the country where the materials were found, as there are often very strict and specific local statutes which govern the conditions under which any such exportation may occur.

Moreover, there are other practical limitations which also pose problems for researchers in this field of archaeological inquiry. Sample populations recovered from Mesopotamian cemetery contexts are limited, both in terms of raw numbers, and also what social and economic sections of ancient society are represented. The succession of conflicts in the region – particularly in Iraq – has also contributed an unfortunate effect; both the numbers and availability of skeletal sample populations is reduced today from what it was before the 1980s, and in some cases, archaeologically-recovered cemetery populations have either been destroyed outright or disappeared due to ongoing political strife in the region (as was unfortunately the case at Abu Salabikh; J.N. Postgate; personal communication). Even where sample populations remain intact, issues of access and preservation still hinder archaeological study of those cemetery groups. The latter problem is particularly of concern in the analysis of stable isotopes, as it is often not possible to gauge the degree of isotopic contamination (called diagenesis), if any, without the assistance of sophisticated equipment (this will be discussed in more depth later).

Ultimately, however, despite these acknowledged difficulties, the study of political economy in Early Dynastic Mesopotamia with stable isotope analysis can not only further the understanding of Early Dynastic Mesopotamia, but also demonstrate the use of isotope data in the investigation of broader anthropological questions, like political economy and the activities and projects of states. The activities which will be discussed in this paper are but a small representative sampling of the potential applications for this technique in the study of abstract sociopolitical and economic practices, which are increasingly being explored with isotopic data. Not only can the specific case studies outlined above serve to illuminate the management of the economic, political and social order by state administrative structures, but additionally, they also illustrate the excellent prospects for enriching the current understanding of how early states functioned as organizational managers by pairing archaeological evidence from the field and historical data from ancient texts with information from the isotopic record.

Chapter 2. Stable Isotope Theory and Ecological Considerations

Theoretical Principles of Stable Isotope Analysis

Isotopes are atoms of the same element which, while having the same number of protons, have differing atomic weights due to a variance in the number of neutrons found within the nucleus. A single element can have multiple stable and/or radiometric isotopes. Because the number of protons in an atom for a given element is constant, regardless of the number of neutrons present in the nucleus, isotopes are typically expressed with the sign ^{Y}X, where X represents the atomic symbol for the element, and Y the atomic weight of the isotope[4].

There are two types of isotopes: stable and unstable (i.e. radioactive) isotopes. The present work is specifically concerned with the analysis of stable isotopes (of which roughly 300 are known; Hoefs 2007: 1). Of these, only 21 elements are "pure" elements - that is, elements which have only one stable isotope species; all other elements have at least two (*ibid*). Carbon and nitrogen - two elements which are featured in this study - are not "pure"; in other words, both elements have multiple stable isotope species.

While different isotope species of a given element have the same electronic structure, differences in atomic mass do have some effects on the physical properties of atoms of different isotope species. Adding or

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[4] In this study, for example, four isotopes will be discussed, which will be represented by the following symbols: ^{13}C; ^{12}C; ^{15}N; and ^{14}N.

subtracting a neutron from the nucleus of an atom can change the rate at which chemical reaction occurs, for example (Hoefs 2007: 3), or the temperature at which phase change occurs (Hoefs 2007: 4 [*Table 2*]).

One kind of process is of particular importance in the study of stable isotopes: isotope fractionation. 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 processes, including "kinetic processes", which are unidrectional reactions, such as evaporation, diffusion, or photosynthesis, and what are called "isotope exchange reactions" (which are sometimes also called "equilibrium isotope distribution"; *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. Regardless of the catalyst, isotope fractionation is also affected by other factors, such as temperature, pressure, and the composition and/or molecular structure of compounds (*ibid*).

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). Relative differences in isotope species distribution 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 that is used as an international standard. The international standard for nitrogen isotopes, for example, is the isotope distribution of AIR (Ambient Inhalable Reservoir), while the international standard for carbon isotopes is the PeeDee Belemnite (PDB). δ is defined as the result of the following equation: [$\delta = ((X_{sample}/X_{standard}) - 1) \times 1000$], where X stands for the ratio of selected isotope species. As this study will focus on carbon and nitrogen stable isotopes, X here would either represent the ratio ^{13}C:^{12}C for carbon isotopes, or ^{15}N:^{14}N for nitrogen isotopes.

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. The international standard for carbon isotopes, PeeDee Belemnite (VPDB), is defined with the $\delta^{13}C$ value of 0‰. Most biological materials have $\delta^{13}C$ values that are negative, which is not an indication that ^{13}C is not present in a substance, but rather that the VPDB standard is enriched in the ^{13}C isotope species in comparison to most other substances.

Carbon is found in two compounds often analyzed in paleodiet reconstruction studies: collagen (a protein which is found in a variety of animal tissues, including bone and dentin) and bioapatite (the inorganic biomineral portion of bone and tooth enamel). These are often denoted by the separate symbols $\delta^{13}C_{coll}$ and $\delta^{13}C_{apatite}$, respectively, and will be designated as such here. The isotopic distribution of carbon in materials such as collagen or bioapatite can be used to infer the sources from which animals acquire energy and nutrients (DeNiro and Epstein 1978). This is possible because carbon isotope ratios in animal tissues are influenced by complex processes involving the exchange of CO_2 between the atmosphere, ocean surface, and organisms that produce energy via photosynthesis. These processes are interconnected, as fractionation that occurs during the transfer of dissolved CO_2 in the ocean to the atmosphere leads to a depletion of approximately 9‰ in $\delta^{13}C$ in atmospheric CO_2, and the atmospheric CO_2 is then depleted further during plant photosynthesis.

Isotope fractionation of carbon during photosynthesis is a process which has particular importance for interpreting carbon isotope data in paleodiet studies, as the ultimate source of dietary carbon in most ecosystems is plant matter. Plants use one of several photosynthetic pathways to take in CO_2 from the atmosphere. The most common of these pathways is known as the C3 pathway, which is utilized by virtually all plants in temperate environments, as well as all trees and in many shrubs in tropical areas. Less common is the C4 synthetic pathway, which is typically utilized by tropical grasses, as well as some sedges. Although C3 plants are the most common found in nature, several C4 plants have been exploited as important staple crops in various parts of the world, including maize in the New World, and millet[5] and sorghum in sub-Saharan Africa, and in parts of South and East Asia. Finally, an even less common third kind of photosynthesis, called Crassulacean Acid Metabolism (CAM), is used by succulents.

Isotopic fractionation rates in C3 and C4 photosynthesis are significantly different from each other (while CAM plants can have $\delta^{13}C$ that fall into either a C3 or C4 range). C3 plants discriminate more against the heavier ^{13}C isotope species than C4 plants, and as a result C3 plants have lower $\delta^{13}C$ values (O'Leary 1981). The mean $\delta^{13}C$ value for C3 plants is -28.1 ± 2.5‰; C4 plants, on the other hand, have a mean $\delta^{13}C$ value of -13.5 ± 1.5‰ (O'Leary 1981: 554). It should be noted, however, that aquatic C3 plants exhibit values more typical of

[5] Millet is also known to have served as an important agricultural product in Southern Italy during the Bronze Age, and apparently also in the Near East, as well (see below).

terrestrial C4 specimens, which O'Leary attributes to a slower CO_2 diffusion underwater (O'Leary 1981: 555).

When animals ingest plant tissues, further fractionation of carbon stable isotopes takes place as dietary carbon is metabolized during digestion, and becomes a component of various animal tissues. Different tissues fractionate dietary carbon at different rates, as do different components of some tissues. In wild animals, collagen fractionates carbon at a rate of ~ +4.5‰ (Lee-Thorp et al 1989: 587)[6]; 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 ~ +3.6‰ (Kellner and Schoeninger 207: 1121). Collagen is widely considered to be representative of dietary carbon acquired from protein sources, such as meat, fish or some plants; as a result, $\delta^{13}C_{coll}$ 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 bioapatite (Ambrose and Norr 1993). However, recent studies have shown that this assumption may need to be reassessed, with $\delta^{13}C_{coll}$ representing instead total diet (Kellner and Schoeninger 2007; Warinner et al 2009).

Archeologically, carbon isotope studies have been used as proxy data for a number of archaeological questions. In the New World, archaeologists have turned to carbon stable isotope analysis to determine when maize-based agriculture was adopted in different parts of North America by exploring the

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[3] There is some debate about this figure, and it may vary even within a given animal.

timing of enrichment in $\delta^{13}C$ across communities (Ambrose et al 2003; Hutchinson et al 1988). A recent $\delta^{13}C$ study of Bronze Age Italian populations similarly determined that northern Italy was characterized during the period by millet-based agriculture, whereas in southern Bronze Age Italy wheat and barley were preeminent (Tafuri et al 2009). Other studies have examined status differences through diet (Ambrose et al 2003; Price et al 2009), gendered food behavior (White 2005), or even the effects of imperial expansion upon the diet of peoples newly-incorporated into empires (Kellner and Schoeninger 2008).

Nitrogen Stable Isotopes

Most of the nitrogen occurring in nature is found in the atmosphere, and as such atmospheric N_2 serves as the international standard, with the standard $\delta^{15}N$ value defined as 0‰. Organic nitrogen bound in plants or other organisms is broken down by bacteria into other, more reactive compounds, such as ammonium or nitrate (Hoefs 2007: 49). Other organisms generally 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 $\delta^{15}N$ values in plants (Hoefs 2007: 50).

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

In animals, nitrogen is found primarily in proteins[7]. Animal protein is typically enriched in nitrogen when compared to plants. Animals that consume

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

terrestrial foods (average $\delta^{15}N$ value of +5.9 ± 2.3‰; Schoeninger et al 1983: 1381 [*table 1*]) have lower $\delta^{15}N$ levels, on average, than those which consume mainly marine foods (average $\delta^{15}N$ value for aquatic mammals of +15.6 ± 2.2‰; for sea birds +12.9 ± 2.9‰; and for marine fish +13.8 ± 1.6‰; Schoeninger and DeNiro 1984: 632 [*table 2*]). It is because the ocean is a longer trophic system that animal tissues of marine food consumers are so enriched (Schoeninger and DeNiro 1984).

In either terrestrial or marine ecosystems, predators exhibit, on average, a +3‰ fractionation rate in $\delta^{15}N$ for each trophic level (ibid). Therefore, although the overall average for $\delta^{15}N$ in terrestrial animals is +5.9 ± 2.3‰, terrestrial carnivores have a higher mean $\delta^{15}N$ value of 8.0 ± 1.6‰ (Schoeninger and DeNiro 1984: 632 [table 2]). As may be expected, humans also exhibit this +3‰ enrichment when they acquire protein from animal sources, 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 $\delta^{15}N$ values in some tissues of a given individual, and these must be considered during any interpretation of nitrogen stable isotope results.

Archaeologically, $\delta^{15}N$ values are used to infer the importance of terrestrial or marine animal consumption in human diet (Schoeninger and DeNiro 1984), and to ascertain whether populations rely more on terrestrial meat or marine foods (e.g., Tomczak 2003). In some cases, access to these resources appears to have been socially- or even politically-restricted in some way, with individuals classed as elites by archaeologists having higher δ15N values than those of non-elites (e.g., Craig et al 2009; Price et al 2009). Similar studies have also explored the social institution of gender discrimination at the level of diet (e.g. White 2005).

The Geography and Ecology of Southern Mesopotamia

Paleodiet studies utilizing carbon and nitrogen stable isotope analysis cannot be successfully interpreted without an understanding of the ecological and environmental conditions of the area under study. Knowledge of floral and faunal foods present in that ecological context is essential, and without this information, it is impossible to determine what isotope values mean. Here, the ecology of Mesopotamia will be briefly described, with special consideration for Mesopotamian marshland and coastal environments.

The ecology and geography of southern Mesopotamia are almost totally dependent on the Tigris and Euphrates rivers. The drainage from these rivers largely sustains terrestrial life in the southern alluvial fan, and was absolutely essential for large-scale agricultural production during the Early Dynastic period. The geography of southern Mesopotamia consists of a flat alluvial plain that is gradually interspersed with marshlands towards the Persian Gulf. As the ancient Greek name for the region suggests, the flat and fertile plains upon which early cities were founded are mostly situated between the Tigris and Euphrates rivers, which function as the primary source of water for agricultural production, the main thoroughfares for transportation and trade. The two rivers – and particularly the faster-flowing Tigris – also serve as natural boundaries that make east-to-west movement difficult. Eventually, the two rivers converge in the marshy delta region of southern Iraq to form the Shatt al-Arab estuary, which subsequently drains into the Persian Gulf.

The importance of the Tigris-Euphrates drainage to Mesopotamia cannot be overstressed – without the continual supply of fresh water provided by the rivers, neither the fertile alluvial fan in southern Mesopotamia, nor the civilizations that emerged upon that plain, would have been possible. Ancient Mesopotamian cities constructed a network of water courses and canals to transport water from the river systems to fields, where staples, principally barley, and secondary crops like chickpeas were grown (Postgate 1992; Riehl et al 2008).

It is easy to draw parallels between Mesopotamia and Egypt, which was similarly reliant on the drainage of the Nile to sustain its urban populations. Both Egyptian and Mesopotamian cities needed the fresh water from the alluvial drainage for agricultural production. Moreover, the Tigris-Euphrates and Nile rivers served as the principal routes of long-distance commercial exchange and transport for the local regional trade system (Ekholm and Friedman 1979: 46). Moreover, for the ancient peoples of both Egypt and Mesopotamia, whose lives depended on irrigation-based agriculture downriver, interannual variation of both Nile and Tigris-Euphrates water levels had no locally-observable natural cause; thus, the rivers were also important elements of cosmological systems, as well as agriculture and trade.

The marshes of southern Mesopotamia appear to have been almost as important to ancient peoples living in the region as the rivers, especially during the ‘Ubaid and Uruk periods (Pournelle 2007). The Mesopotamian marsh system includes both freshwater and saltwater marshes, and it has been suggested that in ancient times, much of what is today freshwater marsh would have been a estuarine or lagoonal environment during the mid-Holocene (Sanlaville and Prieur 2005: 79). In general, saltwater marshes have been described as being "among the most abundant, fertile, and accessible coastal habitats on earth, and they provide more ecosystem services to coastal populations than any other environment" (Gedan et al 2009: 117). The marshlands that were abundant in the lower delta of the Tigris and Euphrates (and particularly that of their confluence, the Shatt al-Arab) appear to have been no exception. Studies have shown that the modern Shatt al-Arab estuary is relatively nutrient-rich when compared to the rest of the Persian Gulf, and that the Shatt al-Arab is an essential source of organic carbon and nitrates for the northern gulf ecosystem as a whole (Abaychi et al 1988).

The fertile alluvial plain, and in particular the wetlands at its southernmost extent, support a wide variety of plant and animal species, many of which cannot live in more arid parts of Western Eurasia. The delta marshlands constitute "the largest wetland ecosystem in the Middle East and Western Eurasia and support a rich biota" (UNEP 2006: 14). The wetlands of southern Mesopotamia support a diversity of life, including a number of freshwater and saltwater fish species, and have also "historically provided wintering habitat for some of the largest concentrations of waterfowl in the world" (UNEP 2006: 14). As recently as the 1980s, substantial human populations exploited the abundant aquatic resources found in the marshes successfully enough to sustain whole communities; carp [8]

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[8] Higher trophic level fish, and to lesser extent omnivorous fish like carp, are enriched in ^{15}N compared to other fish that occupy lower trophic positions (Schoeninger and DeNiro 1984: 632).

is reportedly the species of fish most commonly exploited by modern marsh dwellers, both for subsistence and for secondary products, such as skins (Ochsenschlager 2004: 16; 75).

While it may never be determined exactly how important the marshes - and the Gulf - were in the foundation and early development of the cities of southern Mesopotamia, recently archaeologists have begun to consider seriously the importance of wetland resources to early Mesopotamian communities. It has been suggested that, in ancient times, the marshes, which presumably teemed with a diversity of useful products, such as fish, waterfowl, and other aquatic resources, played a major role in the development and maintenance of those centers during the 'Ubaid period (6th-5th millennium BCE; for a full discussion of marsh resource use in ‘Ubaid and Uruk Mesopotamia, see Pournelle 2007). Many important Mesopotamian cities established during the 'Ubaid, such as Ur, Eridu, and Uruk were all situated in or around marshlands close to where the Gulf was during the Middle Holocene, when the sea levels were higher than they are today and the Persian Gulf extended further into the alluvial fan (see Sanlaville and Prieur 2005). While it is tempting to assume that such an event must have had severe implications for the lifeways of societies experiencing this climate change over time, it remains to be seen what effects the eventual retreat of the sea to its current position, and the drying up of some marshlands which surely followed, had on the trajectory of Mesopotamian agricultural, economic, and sociopolitical life.

Climate Impacts on Southern Mesopotamia During the Holocene

Because Mesopotamia is so dependent on rivers for its water supply, even relatively minor fluctuations in climate can have serious implications for the region. More significant changes in global and regional climate over the past 10,000 years appear to have significantly altered the lifeways of ancient Mesopotamian societies, both for better and for worse. Indeed, climate change is considered so important that some archaeological studies have implicated unfavorable shifts in climate for periods of catastrophic disruption or even collapse in a number of local, and even occasionally regional sociopolitical structures (e.g., Dalfes et al 1997, Weiss et al 1993).

The headwaters of both the Tigris and Euphrates rivers are located in the mountainous highlands of southeastern Anatolia, which is not directly impacted by the monsoon cycle to the south. Winter precipitation in Anatolia is the ultimate water source for both rivers, and especially for the Euphrates; the intensity of this precipitation is largely governed by a larger climatic process known as the North Atlantic Oscillation (or NAO; Cullen and deMenocal 2000). The role of the NAO in determining water levels of the Tigris-Euphrates over the longer term is unclear, as Cullen and deMenocal explain:

> Ongoing research efforts are aimed at understanding whether the NAO, like ENSO, is a coupled ocean – atmosphere phenomenon as opposed to a purely white noise time series. Coupled or ocean-only modes of variability are of interest because they have the potential to elevate predictability over a white noise (atmosphere)–red noise (ocean) system. Should the NAO prove to be predictable, future work should include long-range, early

> warning systems for drought/flood monitoring in the Middle East and the prediction of Turkish precipitation and streamflow. (Cullen and deMenocal 2000: 862)

If the North Atlantic Oscillation does prove to be reliably predictable, then further study of longer-term variability in the NAO during the wetter 6th-2nd millennia BCE could also provide important information about variation of interannual streamflow for the Tigris and Euphrates during that span, and subsequently of its impact on the forms, behavior, and development of early Mesopotamian societies.

Because of warmer and wetter conditions during the Early Holocene, the marshlands of southern Mesopotamia in ancient times were significantly more extensive and probably supported even more biodiversity than they did in the 1980s. During the Early Holocene, the annual monsoon provided significantly more rainfall to southern Mesopotamia than today (Kutzbach and Street-Perrott 1985). Eustatic sea levels were 1-2 m higher during that span and, accordingly, the Persian Gulf extended much further north than it does today (the estimated extent of the Gulf varies, but it is increasingly accepted that the Gulf advanced as much as 100-200 km further inland than its present shoreline; see Hole 1994: 103 [*fig. 6*]; Sanlaville and Prieur 2005: 79).

Sometime around 4000 BCE, the global sea levels fell, and the monsoons lessened in intensity while also moving south toward their present position over the Indian Ocean (Overpeck et al 1996). This brought about a retreat of the Gulf (and subsequently of the marshes), as well as the onset of increasingly drier conditions – present-day aridity was probably established around 1000 BCE (*ibid*). Thus, the Early Dynastic period in Mesopotamia can be characterized by a receding coastline and drier climate than during the ‘Ubaid period, but still wetter than today.

It is unclear what the specific effects of these climate-driven ecological changes were upon the cities and villages of southern Mesopotamia, but it seems likely that they were significant and, for some communities, perhaps even catastrophic. It is precisely because the Third Millennium BCE was a period of transition from the wetter conditions of preceding periods towards those which characterize the region today that understanding the nutritional and economic importance of aquatic food resources to southern Mesopotamian peoples during this time deserves close and wide-ranging investigation.

Chapter 3. Archaeological Evidence for Aquatic and Marine Foods in Early Dynastic Mesopotamia

Archaeological Evidence for Early Dynastic "Invisible" Commercial Export of Fish and Other Aquatic/Marine Products

As stable isotope analysis may be able to shed new light on strategies of economic production in ancient Mesopotamia, it may also be utilized to elaborate on the current archaeological understanding of the trade in perishable commodities - in this case, marine and/or aquatic foods. Archaeologists can potentially use stable isotope analysis to assess who was importing freshwater and/or marine resources as foodstuffs, and who was importing them for other purposes, such as ritual use or personal adornment. However, it is first necessary to provide background on what archaeologists already know about the role of aquatic and marine resources in Early Dynastic society and political economy. To this end, I provide here a brief sketch of the archaeological evidence regarding exploitation of aquatic/marine resources in Mesopotamia, and how stable isotopes can be used to effectively supplement the current archaeological understanding of commercial exchange and elite aggrandizement strategies in Early Dynastic Mesopotamia.

In some ways, Early Dynastic Mesopotamia is a particularly propitious culture area in which to study commodity exchange with stable isotope analysis, because the rich historical record left to posterity by scribes provides a number of details about dietary habits which can be used as referents when interpreting isotopic data. While archaeology in Mesopotamia has long relied on these texts to explain the nature of economic exchange in the region, stable isotope evidence presents a means to “test” the textual accounts left by bureaucrats. Thus, stable isotopes may have a useful role to play in illuminating the nature of the trade in perishable foodstuffs that seems to have characterized much of the economic interactions of the region.

The study of long-distance and/or interpolity commercial exchange 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., Algaze 1993; Baines and Yoffee 1998; Crawford 1973; Ekholm and Friedman 1979; Santley and Alexander 1992). Much is known about the commercial transactions of cities and states in the region during this time, thanks largely to administrative records (Pettinato 1981) and the presence of goods in burials which were clearly imported (e.g., Sertok and Ergeç 1999; Schwartz et al 2006). However, as V.V. Struve has noted, fishing was not typically discussed in Third Millennium accounting texts (Struve 1948: 143), and there is typically even less discussion in the tablets concerning the role of fish in long-distance commercial exchange (Crawford 1973), although there now appears to have been a greater administrative focus on fish as an export than was previously known (see Englund 1998).

There is a convincing body of evidence that indicates waterborne transportation and trade were vital to the economies of Mesopotamian cities during the Third Millennium BCE (see Algaze 1993: ch. 3, 5). The Euphrates and Tigris rivers provided a commercial “highway” for the movement of commodities upriver into northern Mesopotamia, Syria, and Anatolia, while maritime trade routes extended to the city of Dilmun in modern Bahrain, and apparently even even as far as the Indus Valley (Lamberg-Karlovsky 1972).

The inclusion of isotopic analysis into the study of trade in Mesopotamia would be welcome, particularly in light of the fact that a number of archaeologists have suggested that trade and resource accumulation were, at the very least, a significant portion of the socioeconomic foundation upon which Mesopotamian states were built (e.g. Algaze 1993; Crawford 1973; Lamberg-Karlovsky 1972). Indeed, H.E.W. Crawford considers that trade in Mesopotamia was “an essential ingredient without which civilization could not have been attained” (Crawford 1973: 232). Crawford's description of the import-export cycle in the Near East is similar to trade networks of unequal exchange noted in Immanuel Wallerstein's world systems model (see Algaze 1993: ch. 1; Santley and Alexander 1992), although with the added caveat that Mesopotamian cities also functioned as intermediary trading centers for the exchange of products heading to or from other extraregional centers (Crawford 1973: 238).

Given the emphasis on both riverine and maritime trading networks, the ability to construct and maintain watercraft which were viable means of waterborne transport and exchange must have been of major concern to Mesopotamian merchants and administrators. For navigating rivers or shallows, it was possible to construct boats made from reeds which were covered with bitumen as a waterproofing agent (Schwartz and Hollander 2008: 1352), but for larger and more durable craft, a reliable source of high-quality timber was a necessity. As large supplies of wood could not be locally obtained in southern Mesopotamia, this meant that lumber needed to be imported, or some sort of import substitution had to be put into practice. While timber was imported from Syria as early as the Uruk period (Algaze 1993), it now seems that the increasing demand for wood outpaced the ability to supply the need with imports, and Sumerian cities during the Third Millennium appear to have carried out programs to cultivate large numbers of trees in the south (Heimpel 2010; *forthcoming*).

By the Ur III period, the need for timber was apparently so great that a massive effort was made to develop a reliable source of locally-available timber, despite the fact that cultivating large numbers of trees in the southern alluvium would have been both difficult and labor-intensive (see Heimpel 2010; *forthcoming*). Wolfgang Heimpel has recently reported a corpus of texts from this period which give testament to the scale of this enterprise, which appears to have dated back to at least the Early Dynastic III period (Heimpel 2010: 36; *forthcoming*). At the site of Garšana alone, for instance, "[t]here were altogether more than 24,569 pines [grown] in the three gardens". A number of trees at sites such as Drehem, Garšana, Girsu and Ur were specifically cultivated for their use in boat-building (Heimpel 2010: 4, 7, 30, 33, 36; *forthcoming*).

Given that most Mesopotamian cities were situated within a riparian environmental context, and that waterborne transport and trade was so important to facilitating economic development, it should not come as a surprise that a number of archaeologists have argued that fish played a significant role in the subsistence of local urban populations. Robert McC. Adams has proposed that fish were the principal source of dietary protein in Mesopotamia (Adams 1981), although this is disputed; according to Zeder, the importance of fish as a staple food is unclear (see Zeder 1991: 32). What seems more clear is that fish were a processed food in many places, where they were preserved by being smoked, salted, or dried (Crawford 1973: 233). In these processed forms, fish and other marine foods were exported from cities near the sea[9], as well as centers in the marshy southern alluvium, or those near freshwater lakes.

That fishing seems to have been an important economic activity is not disputed. However, the degree to which this was centrally controlled is poorly understood. Based on the conspicuous absence of discussion about fishing in virtually all Third Millennium accounting texts from Lagaš-Girsu and Drehem, Struve has argued that “it seems that both fishermen and herdsmen were beyond the limits of control of the management directing the labour of the men and women on the royal estates at Umma and Lagaš, which specialized mainly in grain production” (Struve 1948: 143). John Baines and Norman Yoffee have also proposed that fishing was instead organized and administered by what they describe as “private entrepreneurs” (Baines and Yoffee 1998: 227).

However, there is some indication that fishing may have become a concern of state administrations by the end of the Third Millennium BCE, if not

[9] The earliest recorded historical reference to this trade has been recovered from Telloh (ancient Girsu), in southern Iraq, which indicates that large quantities of fish were exported inland to the Sumerian city of Nippur (Crawford 1973: 233).

before. Robert Englund noted in 1988 that administrative texts relating to both fresh and dried fish have been recovered from contexts as far back as the Late Uruk period in the preceding millennium (Englund 1998: 70), and certainly by the Ur III dynasty (Englund 1988: 66). More recently, Englund has demonstrated that fish appear to have been not only an important protein source, but a food of sufficient import to city-states that it warranted inclusion into rationing systems of some cities (Englund 1998: 143)[10].

Whatever its dietary significance, and regardless of who organized fishing ventures in ancient times, the importance of fish to the subsistence and economic viability of modern wetland communities is very clear. Edward Ochsenschlager has noted that, among modern Marsh Arabs, carp “provided many families with their major income or trade good” (Ochsenschlager 2004: 16). Englund notes that, in ancient times, carp were one of four species which appear frequently at sites throughout the alluvium during the Third Millennium BCE; two of the four were freshwater, the other two saltwater species (Englund 1998: 132). He goes on to further point out that a variety of other fish remains have been recovered from archaeological contexts of the period, including at least one known example of a Persian Gulf barracuda from the inland Babylonian city of Abu Salabikh (*ibid*).

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[10] Unfortunately, Englund also reports that it is not possible to determine with the texts currently available to Sumerologists whether fresh fish, processed fish, or both were rationed (*ibid*). This also leaves open the question of whether fresh or processed fish were preferred elite foods, which will be discussed in more detail below.

Given that the marshlands were almost certainly more extensive during the Third Millennium than they are today, there is little reason to suppose that a resource like fish which seems to have been abundantly available, and which required a relatively minor labor investment to collect, would have been less important in ancient times than in the 20th century. The scale of a processed fish industry, and to a lesser extent of local marine resource consumption, may provide interesting data from which inferences can be made about political and economic strategies practiced in ancient Mesopotamian states. Zeder notes that "[t]here is considerable textual evidence that, at least in certain periods, the processing of fish was a specialized and highly regulated activity" (1991: 32). Such regulation suggests that this process was, at times, of sufficient economic importance to require significant administrative oversight; this would likely have been the case if processed fish were an important part of the city diet, or if processed fish products were an important commodity for export, or both.

However, Zeder also observes that "[t]hough some coordination of fishing ventures for community-wide provisioning may be needed, this coordination can probably be handled on the local level without much higher-level coordination" (*ibid*). Zeder's observation echoes Struve's argument that fishing was an industry outside of state control. Presumably, the degree of state intervention in the acquisition of aquatic foods depended on the economic importance and scale of fishing and related activities. That is, large-scale *processing and distribution* of aquatic or marine foodstuffs would likely have been the object of administrative oversight, even if small-time subsistence fishing was not. It is with the latter that scribal records are typically concerned (see Englund 1988: 66; 1998: 143).

Thus, the ultimate economic purpose of fishing - in other words, whether fishing was simply an informal practice to take advantage of a locally available resource, or a large and centralized industry geared toward the production of a processed economic commodity, or both - has the potential to be used as proxy data for the degree of importance placed on strategies emphasizing staple or wealth finance by civic administration. The latter form of fishing industry seems to have been utilized at the city of Girsu during Early Dynastic times, which was situated in the southern deltaic marshes of the Mesopotamian alluvial fan. Girsu, according to commercial texts, was apparently a major exporter of marine foods, particularly to the inland city of Nippur (Crawford 1973: 233). Girsu has also archaeological evidence of processing fish, possibly for long-distance transport, in the form of "whole yellow bundles of fully preserved fish skeletons" (Englund 1998: 130).

There is a good deal of evidence which suggests that fish were equally important in the central alluvial plain, even at sites much further from the marshes and the coast. During the earlier Uruk period, at the city of Abu Salabikh, the discovery of large-scale fish consumption (which included a variety of species, as noted above) seems to indicate that fish were a very important food resource at that city, second only to caprids (Pollock 1990: 88). It must be noted, however, that at present it is often not possible to determine whether fish were eaten fresh, or processed in some way (Englund 1998: 143), and by extension, it is also therefore difficult to ascertain in many cases whether fish were acquired locally or imported.

There is also evidence of a thriving marine products trade flowing from coastal centers into the nearby city of Kish. Excavations at Early Dynastic I Kish in the so-called “Y Cemetery” complex yielded a number of shell necklaces and bracelets, as well as what has been described as an “imitation conch shell” (Algaze 1986: 162-163). Ernest Mackay reported that excavations in the EDIII “A Cemetery” burial complex at the city uncovered a significant number of what he described as “pigment shells” (Mackay 1925: 14). These, which he identified as belonging to various species of the *Cardiadae* family, were apparently imported from the Persian Gulf, or some other area of the Indian Ocean, and were probably eaten before the shells were converted into facial pigment receptacles (*ibid*). From the frequent discovery of these imports in burials at A Cemetery, Mackay concluded that the imported shellfish “were doubtless a favorite diet with the people buried in the ‘A’ cemetery” (Mackay 1925: 15) [11].

Mackay also noted that freshwater mussel shells were a frequent, if “scattered” find throughout the city of Kish (Mackay 1925: 15), which suggests that shellfish of all kinds were probably a preferred local food. However, the frequency with which marine shellfish appear in burials at Kish raises the

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[11] Although there is no direct evidence available as yet to support this suggestion, it is worth noting that higher sea levels in the Third Millennium BCE could have made such a trade in shellfish from ancient coastal communities to inland cities more plausible than it would seem to be at first glance.

possibility that higher status people buried in elite mortuary complexes like A Cemetery had access to marine foods that may not have been as widely available as the freshwater mussels. It is probable that social elites were more likely to consume marine foods from far afield than commoners, as the distance which these shellfish were transported suggests that their scarcity would likely have increased their value a a prestige good. Thus far, Mackay's suggestion about the importance of marine foods to elites at Kish has been impossible to test in a scientific manner, but stable isotope analysis of bone collagen samples taken from Kish burials could provide empirical data to support or dispute Mackay's supposition.

The trade in Persian Gulf resources appears to have also extended beyond the Mesopotamian plain. Englund reports that fish remains found in sites on the Susiana plain of southwestern Iran include some marine species which were probably traded in from coastal centers on the Persian Gulf (Englund 1998: 131). In Early Dynastic Syria, marine products such as shells and mother-of-pearl appear to have been imported from as far away as the Persian Gulf (Akkermans and Schwartz 2003: 270). These products were almost certainly prestige goods, which were meant to adorn or otherwise be displayed by social elites. Interestingly, some of these objects were carved into what Akkermans and Schwartz have called "votive figurines", such as a bovid figure found at Qara Quzaq (Akkermans and Schwartz 2003: 274), which suggests that marine products may have been both prestige goods and religious implements in Syria. Whatever the purpose of secondary marine products that have been excavated, there also remains the possibility that some marine foods might also have been imported into Syria, which could be explored with stable isotope analysis.

In addition to the Qara Quzaq figurine, the presence of numerous fish bones and sea shells in archaeological contexts may also indicate that marine resources were an element of religious or ceremonial practices. Pollock has suggested that fish were probably used as ritual offerings rather than everyday foods (Pollock 1999: 105). At some sites, excavated temple contexts have included numerous fish bones, which appear to have been sacrificial offerings (Pollock 1999: 146). One early interpretation of an assemblage of fish remains associated with a structure at Uruk was that this room had been a place where fish were left as offerings (although this interpretation has been disputed by Crawford, who sees the function of that structure as a storage facility for fish in the midst of processing; see Crawford 1973: 234). In some cases, however, fish seem to be associated with ritual or religious activities in the archaeological record, at least in addition to consumption in more ordinary circumstances.

Whatever their purpose, aquatic/marine resources appear to have been an important component in city-state commercial strategies, and were apparently processed for long-distance export, as well as being sought as an imported commodity. By studying the stable isotopes of individuals buried in cities which were known to have imported these resources, a clearer understanding of the role played by non-local aquatic/marine resources in urban diet can be obtained. In centers where fish were processed, exported, or imported, the social importance of these commodities as prestige goods might also be better understood, should access to aquatic/marine foods prove to have been preferentially restricted to elites. Thus, the large-scale production and exchange of these "invisible exports" can shed more light on not only the industrial and commercial practices of Early Dynastic cities, but also on the patterns of local elite consumption.

Stable isotope data could thus help to clear up a number of issues which current archaeological and textual evidence have not resolved. First, stable isotopes could be used to assess the importance of freshwater or saltwater fish, or other aquatic foods, to the daily diet of Mesopotamian peoples. Similarly, at sites where texts have indicated that fish were processed for export, isotope studies could establish whether these resources were meant purely for export, or were a part of local diet as well. Isotopes could also be employed to help ascertain whether the presence of fish at some sites was primarily intended for ritual uses, or if those resources were also a local staple food. Additionally, isotope evidence could illuminate how important these foodstuffs were in regular aggrandizing displays of feasting by social and political elites; similarly, where fish appear to have been rationed, there remains the potential to explore whether either marine or freshwater fish species were reserved primarily for elites. Ultimately, the investigation of these questions could provide archaeologists with important new evidence to explain political-economic priorities and strategies employed by Early Dynastic states.

Chapter 4. Some Hypothetical Stable Isotope Paleodiet Data and Its Archaeological Implications

Some Hypothetical $\delta^{13}C$ and $\delta^{15}N$ Benchmarks for Southern Mesopotamian Diet

In this section, I will propose a few hypothetical Mesopotamian $\delta^{13}C$ and $\delta^{15}N$ values to correspond to possible dietary habits in the region, and discuss what such results would indicate in terms of the importance of aquatic/marine resources in Mesopotamian diet. Although it is not typically possible to perfectly establish the nature and exact percentages of specific foods in individual diets using current isotopic analysis techniques, broader dietary preferences can be understood with isotope data. For example, isotope data have been used in a number of archaeological studies to successfully identify the presence of a marine foods component to human diet in other areas (e.g. Tomczak 2003). After providing some hypothetical isotope data, the potential significance of these data to archaeological issues of Mesopotamian political economy will also be discussed.

I begin here by mentioning a few limitations of these hypothetical data which will be presented below. For one thing, these carbon and nitrogen isotope values reflect very simple diets, which are meant to show extreme dietary compositions for the purposes of highlighting the differences in which reflect reliance on specific kinds of food resources. It must be said that the stable isotope benchmarks shown above are based on isotope data reported from other geographical and temporal contexts, and furthermore, that the diet ratios used in these examples are are much less complex than most real human diets. This means that the hypothetical carbon and nitrogen values suggested here are presented only as rudimentary “mileposts” to illustrate how different subsistence strategies can be indicated by isotope data. These $\delta^{13}C$ and $\delta^{15}N$ values are very basic models, and can in no way be relied upon as authoritative measures of what should be expected from Mesopotamian diet without taking into account other mitigating factors that could affect the data.

However, even if these examples can only exist as conjecture, I contend that it is still both instructive and necessary to consider the possibilities for $\delta^{13}C$ and $\delta^{15}N$ values, if any discussion of the implications of such data in future Mesopotamian paleodiet studies is to be rendered worthwhile. Should the diet of Mesopotamians prove to be relatively uniform, it becomes possible to isolate not only the extent to which populations relied on aquatic resources for protein, but also whether aquatic food resources consumed by those populations came from freshwater or marine habitats. This is possible because marine and freshwater animals typically display markedly different $\delta^{13}C$ [12] and $\delta^{15}N$ values[13]. Studies have indicated that fish or other aquatic animals living in freshwater environments appear to exhibit $\delta^{13}C$ values typical of C3 terrestrial feeders (e.g., Fry et al 1999; Schoeninger and DeNiro 1984), while marine animals, even those

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[12] For these hypothetical isotope values, $\delta^{13}C$ will always represent $\delta^{13}C_{coll}$.

[13] An exception to this rule must be made in the case of marine fish living in coral reef environments, which have similar $\delta^{13}C$ and $\delta^{15}N$ values to terrestrial C4 herbivores (Schoeninger and DeNiro 1984: 637).

feeding on marine C3 plants, appear to have $\delta^{13}C$ values more typical of terrestrial C4 plants (Al-Zaidan et al 2006; Fry et al 1999). It has been suggested that, at least where C4 input is not a confounding factor, marine animals can be distinguished from terrestrial C3 feeders as a result of this difference in $\delta^{13}C$ (Schoeninger and DeNiro 1984: 637).

It is possible that $\delta^{13}C$ values alone could clarify the role of aquatic/marine products in both the subsistence and wealth economies of Mesopotamian cities. In a study of $\delta^{13}C$ values from nearshore and offshore fish collected in Sulaibikhat Bay, Kuwait, all marine consumers analyzed - including both crustaceans and fish - had $\delta^{13}C$ values typical of C4 terrestrial plants (the mean values reported ranged from -14.72 to -10.49; Al-Zaidan et al 2006: 32 [*Table 3*]). This indicates that, for people living near the Gulf, a diet heavy in marine fish would appear in bone collagen $\delta^{13}C$ values that are very high. Because the primary crops in southern Mesopotamia are all C3 photosynthesizers (see Riehl et al 2008), if bone collagen samples exhibit high $\delta^{13}C$ values, these can be safely attributed to a reliance on marine (or saltwater marsh) foods. Unfortunately, $\delta^{13}C$ values reported for freshwater fish are typically indistinguishable from those typical of terrestrial C3 plants, including Mesopotamian staple crops; thus, $\delta^{13}C$ values alone cannot indicate a diet rich in freshwater aquatic foods.

As $\delta^{13}C$ values alone cannot be relied upon to indicate consumption of freshwater aquatic foods - particularly fish, such as carp - the presence of these resources in Mesopotamian diet could be attested by $\delta^{15}N$ values which are higher than values typically expressed for populations eating purely terrestrial foods. According to Schoeninger and DeNiro, marine fish which feed mainly on invertebrates typically have δ^{15}N values of approximately ~+14.1 ± 0.9‰ (Schoeninger and DeNiro 1984: 632 [*Table 2*]), while marine fish consumers typically exhibit δ^{15}N values around +13.7‰ (*ibid*). Fry *et al* reported that freshwater fish living in marshes around Lake Okeechobee in Florida had δ^{15}N values which ranged from ~+6.5‰ to ~+10.5‰ , depending on largely on trophic level (Fry et al 1999: 592 [*Fig. 2*]); their results indicate that a large omnivorous fish like carp would likely have δ^{15}N values which fall at least into the range of terrestrial carnivores (> ~+8.0‰; see Fry et al 1999: 592 [*Fig. 2*]), which tally with similar results reported by Schoeninger and DeNiro (1984: 632 [*Table 2*]). In the Florida study, fish in freshwater marshes were reported to have a mean δ^{15}N value which was typical of terrestrial carnivores (~+8.5‰; Fry et al 1999: 591: [*Fig. 1*]), while marine fish were reported as having a higher mean δ^{15}N value (~ +12‰; *ibid*), which is also similar to values reported by Schoeninger and DeNiro (1984: 632 [*Table 2*]), although the mean δ^{15}N value for offshore fish in Florida is slightly lower.

Given these mean values, it is possible to suggest what Mesopotamian diets which incorporated significant amounts of either aquatic or marine resources would “look like” isotopically. For instance, if fish were the primary source of protein for early Mesopotamian populations, as Adams has suggested, then such a subsistence strategy should be reflected in δ^{15}N values of bone collagen sampled from Mesopotamian cemetery groups that are typical of consumers of fish. It would also be possible to propose $\delta^{13}C$ and $\delta^{15}N$ values that would differentiate between a reliance on freshwater and marine foods, or a mix of both.

For instance, if Mesopotamian communities fed exclusively on fish living in freshwater marshes, such as carp, then their $\delta^{13}C$ and $\delta^{15}N$ values would reflect this. Schoeninger and DeNiro report that freshwater fish had a mean $\delta^{13}C$ value of -19.7 ± 4.5‰, and a mean $\delta^{15}N$ value of +8.0 ± 1.2‰. (Schoeninger and DeNiro 1984: 632 [*Table 2*]); humans whose diets consisted almost entirely of freshwater fish would thus have $\delta^{13}C$ values of roughly -15.5‰, and $\delta^{15}N$ values of approximately +11‰. A diet of pure barley (which has a $\delta^{13}C$ value of roughly -23‰, and a $\delta^{15}N$ of roughly +3‰; see Riehl et al 2008) would be indicated in collagen values of roughly -19.5‰ for $\delta^{13}C$, and approximately +6‰ for $\delta^{15}N$. If the diet of Mesopotamian communities consisted of 50% barley and 50% fish, then both $\delta^{13}C$ and $\delta^{15}N$ values taken from bone collagen samples would fall between those for groups subsisting purely on freshwater fish and those for purely agrarian consumers. In this example, individuals who ate a diet with equal portions of barley and freshwater fish would have $\delta^{13}C$ values around -18‰, and $\delta^{15}N$ of approximately +9‰.

While modern marsh-dwellers rely mainly on freshwater fish, it bears repeating that higher sea levels in Early Dynastic times suggest that much of the marshland would have been saltwater marshes or lagoons, which would support fish that exhibit carbon and nitrogen isotope values more typical of marine fish (Al-Zaidan 2006: 32 [*Table 3*]). If this was the case, then consumers of saltwater marsh resources should also exhibit isotope values which reflect a reliance on those foods. Given the environmental conditions of the Early Dynastic delta, I will focus my discussion primarily on marine foods, although I add the caveat here that freshwater resources are known to have been important in some urban centers (for instance, at Kish; see above).

A diet heavy in marine foods would have values distinct from a diet which relied primarily on either terrestrial foods, or freshwater resources. Marine fish were reported by Schoeninger and DeNiro (1984: 632 [*Table 2*]) as having a mean $\delta^{13}C$ value of -12.5 ± 1.4‰ (which falls in the middle of the range of $\delta^{13}C$ values reported in Al-Zaidan et al 2006), and a mean $\delta^{15}N$ value of +13.8 ± 2.9‰. Thus, if Mesopotamian communities subsisted exclusively on saltwater fish species, then this would be reflected in approximate $\delta^{13}C$ values of -8‰, and $\delta^{15}N$ values of +17‰. If these communities ate a diet of 50% barley and 50% marine fish, then this would be isotopically reflected by $\delta^{13}C$ and $\delta^{15}N$ values of roughly -13‰, and +12‰, respectively. These values are higher - by 4‰ for $\delta^{13}C$, and 3‰ for $\delta^{15}N$ - than the hypothetical values presented here for a mixed diet of freshwater fish and barley.

As the data presented here clearly indicate, a predilection for lagoonal or marine foods would appear as distinct from terrestrial or freshwater resources, and that such a diet would be visible in isotope data. This has potentially significant implications for the study of marine foods as economic resources ("invisible commodities") in Early Dynastic Mesopotamian cities. Because carbon and nitrogen isotopes of marine animals are so distinctive, it is relatively easy to identify significant contributions of marine foods to human diet. Because marine foods are so distinctive, it is also possible to isotopically trace the exportation of marine foodstuffs from coastal centers like Girsu to inland cities such as Nippur or Kish, as these marine food resources could only have been collected in or near the Persian Gulf. As a result, stable isotope data can, in the case of marine foods, be used to acquire new information about the political economies of ancient Mesopotamian cities, and more specifically, what kinds of long-distance commercial exchange relationships in which those cities were engaged.

Archaeological Implications of Hypothetical Isotope Results in Third Millennium Mesopotamia

The prospects for identifying any aquatic contributions to Mesopotamian diet are good, especially if those foods were marine fish or other marine fauna, which tend to exhibit higher $\delta^{15}N$ values than most terrestrial animals (Schoeninger et al 1983). Indeed, marine foods are so distinctive that it has been possible to suggest isotopic models predicting likely $\delta^{15}N$ values for humans that were primarily marine consumers (see Richards and Hedges 1999: 719 [*fig. 2*]). Even freshwater fish, which have $\delta^{15}N$ values similar to terrestrial carnivores, would appear as a relatively distinctive signature in nitrogen stable isotope data, as the vast majority of meat known to be consumed in Mesopotamian cities came from herbivorous ungulates.

Thus, large-scale consumption of fish, and particularly marine fish, or large freshwater which were higher order predators, would likewise be indicated by relative enrichment in $\delta^{15}N$ in humans when compared to terrestrial animals that are not consumers of marine foods. It should therefore be possible to explore just how prevalent and widespread the trade in marine resources was, given the availability of a sufficient human skeletal sample for analysis.

Paula Tomczak has effectively demonstrated that isotopes can be used to trace the dissemination of marine food resources from coastal settlements to inland ones in the past. She investigated differences in local diet among four contemporaneous Chiribaya polities in the Osmore Valley of Southern Peru -

each progressively further inland from the last - with carbon and nitrogen stable isotopes (Tomczak 2003). Because marine fish are generally enriched in ^{15}N compared to terrestrial animals, or even freshwater fish (Schoeninger and DeNiro 1984: 631), the appearance of high $\delta^{15}N$ values that are inconsistent with local ecology could indicate that marine resources were imported to a site from other centers with greater access to those resources.

Based on the results of her analysis, Tomczak determined that, while average $\delta^{13}C$ levels were relatively consistent in samples from all four polities (and with a diet in which maize has a central element), the mean δ15N levels were progressively more depleted at settlements further inland (Tomczak 2003: 273). The results of carbon and nitrogen isotope analysis illustrated that the most inland site (El Yaral, which had a mean $\delta^{15}N$ of +11.85 ± 1.99‰; Tomczak 2003: 269 [*table 1*]) was by far more depleted in ^{15}N when compared to the coastal site of San Geronimo (mean $\delta^{15}N$ of +20.94 ± 1.48‰; *ibid*). Based on her data, however, Tomczak concluded that the El Yaral $\delta^{15}N$ values were still relatively high when compared to other sites which consumed purely terrestrial diets, leading her to conclude that there was probably some kind of supplemental component of marine foods acquired from the coast by some form of exchange (Tomczak 2003: 273).

Tomczak's Chiribaya study demonstrates the feasibility of finding isotopic evidence for marine resource consumption at inland sites. Marine foods, in particular, are especially enriched in ^{15}N when compared to terrestrial sources of protein - sometimes very significantly (as illustrated above by the difference in

$\delta^{15}N$ between San Geronimo and El Yaral) - these foods are relatively easy to identify with nitrogen isotopes. In Mesopotamia, where there was apparently some significant export of marine resources, particularly from southern cities like Girsu, analyzing human skeletal remains may provide not only an idea of how important fish were as a local source of protein where available, but also give some evidence for long-distance trade in marine resources elsewhere. By analyzing nitrogen stable isotopes in bone collagen from individuals at inland sites with evidence for the wholesale importation of marine resources as supplemental foods, it becomes possible to assess the importance of marine foods in the subsistence economies of those centers.

A number of further speculative inferences could be drawn from the results of carbon and nitrogen isotope studies. If, as suggested in the hypothetical example above, sites which have been flagged as centers of either marshland or marine fishing industries exhibit little or no trace of marine-based diet in isotopic data, then these data might indicate not only that fishing was a commercial venture based around export, but that the presence of such a specialized industry further suggests a strong administrative predilection for using fish as commodities for long-distance economic exchange, rather than as staple food resources. Similarly, at sites where large quantities of aquatic/marine faunal remains have been associated with temples, should stable isotope data indicate that aquatic/marine foods were *not* important to local subsistence, then the presence of aquatic faunal remains could be an indication that fish were imported for a religious function, rather than as foodstuffs.

At Kish, for instance, where the purpose of imported marine resources remains unclear, isotope analysis could illuminate not only whether marine foods were consumed, but also by which subsections of society. While Mackay has concluded that shellfish were a favored food of the Kish elite (based on the presence of cockle shells in A Cemetery burials), the finding of these shells in burials could also be explained as the deposition a cosmetic luxury good which was never intended to be anything else. Analyzing the isotope composition of individuals buried at Kish could better establish the purpose of these marine goods. If the remains from elite burials excavated from the A Cemetery at Kish have relatively high $\delta^{13}C$ (>-15‰) and $\delta^{15}N$ values (>+10‰), then this could indicate that the shells are evidence of a significant reliance on marine foods by Kish elites, rather than a reflection of exclusively importing marine secondary products into that city.

Should stable isotope studies from Kish indicate that marine foods were consumed regularly enough to appear in isotope data, this could also provide more information about diet-based aggrandizement strategies of Mesopotamian elites. The consumption of marine resources at inland sites to in Babylonia, such as Kish, which are far from the marshes and the Gulf, could indicate that these foods were valued for their scarcity, and for the difficulty and expense with which they were obtained from cities in the south. The prestige associated with marine resources would partly stem from the distant point of origin with which these resources are associated, as the ability to acquire goods from faraway places often generates social prestige (Helms 1988). If this was the case, then it seems reasonable to suggest that marine resources might have been a prestige good at other inland urban centers, such as Nippur.

Of course, if, as Mackay has suggested, there was social prestige associated with the acquisition of marine foodstuffs on the part of elites at Kish or other inland cities, then this would have influenced the strategies of Kish. The city's merchants would have to ensure a supply of marine foods could reach the local elites so as to satisfy this dietary preference, which would likely have impacted the commercial behavior of Kish. Similarly, should isotope studies at inland sites reveal relatively high $\delta^{15}N$ levels for high-status individuals as described above, then this finding could perhaps indicate preferential access to marine foods at those inland centers for social elites, at the expense of other segments of Kish society (although this could not be confirmed without comparing such data with isotope results from lower class individuals). In this way, social prestige associated with the consumption of these rare goods would be concentrated among the elite classes.

Conversely, it would be interesting to ascertain whether fish, as a widely-available local staple, were eschewed by local elites of cities that were marine food processing centers, perhaps in favor of non-local resources, such as exotic fruits, or terrestrial animal products such as meat or cheese. Should elite individuals from cities like Girsu, which appear to have processed large quantities of marine foods for export, exhibit relatively low $\delta^{15}N$ values ($<+8‰$) that do not fit the predicted values for a diet heavy in saltwater marsh/marine foods, then this could indicate that the elites chose not to partake of these resources for some reason. At Girsu, low $\delta^{15}N$ values in bone collagen samples taken from elites would certainly not be an indication of a lack of aquatic/marine foods. Such a result would, perhaps, illustrate a strategy on the part of elites to differentiate themselves from the rest of the city by eating different foods, as the evidence from Girsu suggests that fish were abundant enough to support a major export industry.

Stable isotope analysis could also be employed to investigate whether access to aquatic/marine resources in Early Dynastic centers was also restricted on the basis of gender, as well as class. A stable isotope study which analyzed data from the imperial Roman city of Velia, in southern Italy, provides an excellent model for such a study in Mesopotamian contexts. At Velia, it seems possible that marine foods were preferentially restricted to some elite males. Though Velia was a seaport situated on the Tyrrhennian coast, the isotope data of sampled individuals from the site indicated that grain was the primary food resource, with only minor contributions from meat or marine foods (Craig et al 2009: 581). However, there appeared in the results of isotopic analysis significant variation in $\delta^{15}N$, with a small number of individuals (mostly males) exhibiting higher $\delta^{15}N$ levels that were consistent with a more marine-rich diet (Craig et al 2009: 580). This finding raises the possibility that these individuals were either higher status males who could afford larger amounts of marine foods, or otherwise that they might have been immigrants to Velia from somewhere else where marine foods were a more important component of diet (*ibid*). Thus, despite Velia's advantageous location for acquiring marine foods, it seems that either these were not a significant staple food, or that access to marine resources was perhaps restricted to socially elite males.

A study similar to that conducted at Velia could inform Mesopotamian archaeology about the existence (or lack) of gendered food behavior. If access to marine foods was partially or fully restricted to elite males at sites like Kish, then isotope values for males and females would be markedly different, even if other archaeological data indicate that those individuals appear to have been of similar social status. Finally, a comparison of results from stable isotope studies designed to explore class-based and gendered dietary differences in cities such as Kish could provide new insights regarding how pervasive the influence of social hierarchy was on everyday life in Mesopotamian urban societies in general. Thus, stable isotope data could be used to explore how rigid (or flexible) the structures of hierarchical difference that long have been assumed to exist in ancient Mesopotamia actually were, at the level of basic subsistence.

Chapter 5. Concluding Remarks and Directions for Future Research

This study has been presented to illustrate several applications for stable isotope research in Mesopotamian archaeology. More specifically, these techniques provide a window into aspects of ancient political economy, such as production strategies or elite self-aggrandizement, which other lines of evidence cannot always penetrate. Taken together, stable isotopes and other archaeological data can provide a much clearer picture of what took place in the past than any specific methodological practice can by itself.

For the sake of coherency and brevity, the scope of this analysis has been limited to the topic of political economy during the Early Dynastic period. However, this organizational choice should not be taken as an indication that isotope research has little use in the study of other broad areas of archaeological (and indeed, anthropological) interest. Briefly, a few comments will be presented here to provide a rough sketch of the applications of stable isotope analysis in several of these areas, including early urbanism and urban immigration; the production of ethnic identity; and gendered food behavior in Mesopotamia. It is my hope that stable isotope analysis will eventually be brought to bear toward the archaeological study of these, and other equally important social, political, and economic behaviors in ancient Mesopotamia which have not been included in the present work.

Early Urbanism, Immigration, and Resettlement

All states, regardless of their size or social complexity, must be capable of organizing and managing labor. States generally require large pools of available labor in order to function efficiently, but must also consequently 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 architecture, 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.

The development and maintenance of early urban centers has been a frequent topic of discussion in archaeology (e.g., Childe 1950; Balkansky 2004; Smith 2009). In the Near East, incipient urban development has been attributed to a variety of causes, including a combination of agricultural surplus and increasing economic specialization (Childe 1950), or trade (Crawford 1973), which could potentially be reflected in the isotopic record.

Immigrating to an urban center was a potentially dangerous prospect in ancient Mesopotamia. Early cities in Mesopotamia (and elsewhere) were 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 1977 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 is has been suggested that immigrants were often needed to sustain the population of early cities, especially as economic specialization increased. Thus, a city's population was in constant 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). Immigration to urban centers was, in all likelihood, 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 was incorporated of 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).

The problem of keeping urban population levels steady was solved by city authorities in a number of 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[14] - a commodity which was both valuable and readily obtainable, much to the distaste of most modern scholars - was another solution.

Lower class laborers (wage-laborers or slaves) were probably the largest segment of immigrating populations in ancient Mesopotamia, and were routinely brought into cities from elsewhere to assist in construction projects or other labor-intensive tasks, where by force or by inducement (Heimpel 2009: 45, 48-52). However, this was by no means the only social class which experienced periodic relocations. Merchants, for instance, 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 (Postgate 1992: 212-216). Another kind of immigration in ancient Mesopotamia involved the reassignment by large territorial states of middle-ranking officials - often drawn from families of "lower ranking

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[14] Larger territorial systems, such as the Akkadian and Assyrian empires, found that another solution was to conquer smaller neighboring polities, and then enslave the populations of the latter, resettling them elsewhere within the empire where labor was required (Oded 1979). However, such an aggressive tactic required a large and permanent military, and the economic resources to wage campaigns of conquest on a massive scale, so it is unlikely that Early Dynastic states, which were generally small, often resorted to such aggressive measures to resolve labor shortages.

core elites" - from core cities to administrative posts in the provinces[15] (Santley and Alexander 1992: 35).

Migrations were also, on occasion, caused by political upheavals, especially wars. Some states, notably the Akkadian and Assyrian empires, forcibly resettled whole populations as part of a strategy of consolidation for recent conquests (see below for a discussion of this practice in more depth). The frequent sacking or destruction of cities by rival polities, such as the apparent destruction of Tell Brak by Sargon (Akkermans and Schwartz 2003: 278), would also have forced refugees to emigrate elsewhere.

Regardless of the reasons for their resettlement, the sudden influx of new people to ancient cities likely left a material imprint, which can be found in the archaeological record. There are a number of ways in which the presence of immigrant communities has been accounted for archaeologically. McNeill (though himself not an archaeologist) has proposed the availability of a linguistic proxy in Mesopotamia, pointing to the gradual replacement of Sumerian-speaking populations in the southern alluvial plain by Semitic-speakers as evidence of the steady flow of the latter group into what were originally Sumerian urban centers (McNeill 1976: 81). ANother common method of inferring processes of immigration involves assessing changes in the physical size of settlements over time (Akkermans and Schwartz 2003: 268). Other methods for

[15] The process of provincial administrative assignment here described by Santley and Alexander seems to me analogous to those of later imperial bureaucracies, such as colonial administrations in early 19th century Europe. It would be interesting to know if ancient provincial bureaucrats saw their positions in a light similar to those of later colonial officials.

assessing the migration of communities into early cities have focused on material culture, particularly ceramic types or differences in stylistic motifs (Akkermans and Schwartz 2003: 270).

Isotopic analysis has been employed in the study of human migrations, as well. Most of these studies have involved the analysis of strontium and oxygen isotopes[16] from samples of human bioapatite (e.g., Knudson et al 2004), while a smaller number of studies using carbon and nitrogen stable isotopes have also been used to tackle archaeological problems of migration and colonization (e.g., Keenleyside et al 2006). Though the former method is more commonly associated with migration studies, the latter also has potential uses for researchers interested in understanding the process of urban immigration.

It seems likely that a steady flow of immigration to urban areas was commonplace throughout Mesopotamia, as McNeill and others have suggested. If this was the case, then the diets of ordinary urban residents were probably also quite varied, as immigrants coming from diverse environmental contexts could appear to have very different diets. By comparing the $\delta^{13}C$ and $\delta^{15}N$ values of bone collagen (and also of strontium and oxygen isotopes from bioapatite) within a cemetery group, it is thus hypothetically possible to infer the presence of relatively recent immigrants into a community. Immigrants would likely appear as outliers in isotopic data, particularly if grave goods or other archaeological information did not indicate an obvious difference for those individuals from the

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[16] Strontium-oxygen isotope analysis is a common means of studying migration. I will not address the method in detail here, however, as it is beyond the scope of this assessment.

main group, such as a particularly high or low status. Or, conversely, if the data suggest no overall pattern in dietary practices, this could also suggest that the community was made up primarily of recent immigrants.

Isotopic analysis further shows promise as a means to identify individuals associated with trading colonies, particularly when paired with written records pertaining to the activities of merchant enclaves. Merchant activity from the Second Millennium BCE can serve as an excellent example of how data from stable isotopes could be used to infer the presence of foreign merchants in Mesopotamian cities. During that era, merchants from the city of Aššur established a long-term presence in a number of far-flung trading centers throughout the Near East, such as Kültepe in Anatolia, Sippar in Babylonia, and the Hurrian city of Nuzi (Postgate 1992: 213). At Nuzi, where texts indicate that millet was a staple crop (Cross 1937: 38), a significant difference in $\delta^{13}C$ values among a small number of sampled individuals of the appropriate social class could demonstrate the burial of some of those Old Assyrian traders. Similarly, the presence in elite mortuary complexes of obvious isotope outliers could indicate the presence of newly-immigrated social elites to an urban center, particularly if the potential immigrant had $\delta^{13}C$ or $\delta^{15}N$ values consistent with another kind of environment (e.g., an individual with a high $\delta^{15}N$ value consistent with marine diet being found in an inland site, where other elites had much lower $\delta^{15}N$ levels).

Immigration is a process which is inextricably linked to the rise of early cities, but the experience of immigrants to ancient urban centers in Mesopotamia is something which can only be conjectured. However, some elements of that traumatic transition from rural village life can, perhaps, be inferred with archaeological proxies. It is conceivable that isotopic analysis could make visible changes in dietary practice among new urban dwellers which could, along with osteological and other data, make possible some understanding of the hardships faced by immigrants in early cities. Though such inferences, admittedly, would not be unproblematic, the potential remains to explore the realm of ancient immigrant experience with indirect proxies, such as stable isotope data.

Diet, Stable Isotopes, and the Production of Ethnic Identity in Ancient Mesopotamia

While the production of ethnicity has become increasingly of interest in archaeology in recent years, much of the research being done in this subfield is based on the work of ethnographers, who are well-placed to study the processes by which ethnic identities are formed, maintained, and altered. Sociocultural anthropologists often study the role of diet in forming and maintaing cultural identities (e.g., Appadurai 1988; Ferrero 2002). Indeed, some anthropological studies have suggested that cuisine is one of the most common - and often symbolically-loaded - expressions of ethnic group identities (Ferrero 2002), and in some cases, foods themselves can profoundly impact other cultural behaviors (Mintz 1985).

For archaeologists, who do not have the luxury of living informants, reconstructing the associations of diet with group identity becomes a matter of inference, which is informed by archaeological and, where available, ethnographic or historical data[17]. The study of this construction of "otherness" has been explored in a number of archaeological studies, mostly through ceramic analysis and/or faunal analysis, such as changing trends in cookware (Smith 2003; Yaeger et al 2004), or trade or consumption patterns (Dietler 2007).

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[17] Ethnographic analogy can play an important role in this area of speculation. Indeed, it goes almost without saying that not a few archaeological studies of identity construction in the past have relied on examples drawn from ethnographic accounts.

In ancient Mesopotamia, ethnicity appears to have been an uncertain category. In texts, no word corresponding to “ethnicity” is known which expressly references physical characteristics or cultural categorizations; rather, distinctions between peoples appear to have been largely based on perceived cultural complexity (Bahrani 2006). In other words, distinctions were not made based on language, dress, or physical appearance so much as they were made on the basis of whether or not a given group was considered “civilized” or not. While this designation is, obviously, a subjective category, it remains distinct from modern notions of ethnicity which are rooted in the notion of a shared ancestral linguistic or cultural heritage.

Practically speaking, however, “ethnic” distinctions in ancient Mesopotamia certainly involved knowledge of culinary habits. One Babylonian text quoted by Zainab Bahrani illustrates the connection between diet and “civilization”: “He [an Amorite] digs up truffles and is restless. He eats raw meat” (Bahrani 2006: 55). It is clear in this Old Babylonian account that, at least for the author of this text, some dietary practices were markers of a “civilized” individual, and others were not. It is noteworthy, however, that the Amorites which the text is denigrating were a West Semitic-speaking people who were active in Syria (Postgate 1992: 36; 42-3), and were as a result linguistically distinct from Babylonian or Sumerian peoples living in the alluvial plain.

Stable isotopes could be employed in this field of research to answer a specific question: “Does the production of ethnic distinction in Mesopotamia - that is to say, the notion of “civilized” and “uncivilized” peoples - actually correspond to differential dietary practices, or are textual accounts which make such claims merely propaganda?" If socially-important Amorites, for instance, appear to have eaten foods similar to those of Old Babylonian elites, then it raises the question of whether the production of difference in the fragment of text quoted above was purely fictional. However, if, by contrast, there are clear differences in diet that are indicated by carbon and nitrogen stable isotope analysis, then this could indicate that there was, perhaps, more of an "ethnic" component to the notion of "civilized" behavior than might at first be supposed.

Stable Isotopes and Gendered Food Behavior in the Ancient Near East

While I have suggested the possibility of studying gendered food behavior among elites at cities like Kish through investigations of marine food access, other studies of gendered food behavior in ancient Mesopotamia would also provide valuable new insights into the social organization of gender roles. Although archaeology has traditionally not been concerned with examining structures of gender inequality in ancient societies, this area of study has expanded steadily since the early 1970s (Conkey and Spector 1984: 13). Gender archaeology (sometimes called “feminist archaeology”) is a subfield of the larger discipline that seeks to call attention to the situation of women in the past, and also to redress gender bias within the archaeological community. This interest has led to a great exploration of aspects of gendered social behavior in the past, which include differentiated ritual practices (Marcus 1999) and gendered labor regimens (Spector 1983).

Isotopic paleodiet reconstructions have also been utilized in the archaeological study of ancient gender relations (e.g., White 2005). This topic has been more thoroughly explored in the New World than in Old World settings, largely because of the fact that relatively few isotope studies have been conducted in the Old World generally, and also because the heavy reliance of pre-Columbian agricultural societies on maize (which is a C_4 crop) makes differential access to staple foods relatively easy to assess. However, this does not mean that culture areas which do not exhibit reliance on a C_4 plant-based diet cannot also yield new information about gendered behavior patterns. Access to foods rich in protein, particularly meat or fish, also show promise as a means to study culturally-constructed gender difference in the past with stable isotopes (see Craig et al 2009).

In Mesopotamia, gender archaeology is somewhat underdeveloped, but there are a number of gendered behaviors which appear to have been practiced in Early Bronze Age Syria that deserve further investigation (including isotopic analysis). On the basis of Eblaite texts, Pettinato claims that women at Ebla were accorded higher status than elsewhere during the Early Dynastic period (Pettinato 1981: 4-5); this claim could be tested, insofar as dietary equality is concerned with stable carbon and nitrogen isotope studies. At Umm el-Marra, Schwartz *et al* have noted an interesting pattern of gendered burial practices; in some tombs, females were buried with many more grave goods than males (Schwartz et al 2006: 631). They also note that lists of funerary goods from Ebla appear to indicate that the practice was also known at that city, indicating that, in Syria, at least, the status of women is unclear (*ibid*).

While Schwartz *et al* conclude that this practice probably involved a kind of statement of familial prestige (*ibid*), the possibility of a relatively high female social standing in early Syria is intriguing. It would be interesting to compare the $\delta^{13}C$ and $\delta^{15}N$ values of the males and females from these graves to see if the pattern of grave goods is reflected in the diets of those individuals. Similarly, a comparison of female stable isotope data from cities in northern and southern Mesopotamia, western Syria (i.e., Ebla and Umm el-Marra), and the Khabur and

Balikh drainages in northeastern Syria, could also provide potentially valuable insights into the diversity of social institutions of gender-bias, as well as how widespread these were, at least with respect to diet.

Concluding Remarks

This study has discussed the potential uses of stable isotope research in Mesopotamian archaeology, and has argued for the inclusion of this analytical technique in the study of Early Dynastic political economies, in particular. By considering and illustrating specific kinds of stable isotope studies that could be used to elucidate processes of production, exchange, and consumption, I have shown that this kind of analysis is viable and would add valuable new insights to the archaeology of Bronze Age Mesopotamia. The importance of stable isotope data as an independent standard by which written accounts can be confirmed cannot be overstated, as the former kind of information provides a quantifiable basis for interpreting and assessing the accuracy of the latter. Moreover, where no textual record has yet been recovered, isotope data can provide a starting point, along with more traditionally-obtained archaeological data, from which to explore the characteristics and behaviors of past social systems in detail.

Isotope analysis is, ultimately, more than just a means of explaining patterns of dietary consumption. I contend that stable isotope research is precisely the kind of analysis that Robert McC. Adams has called for in Mesopotamian archaeology: a means to better understand the situation of people whose existence, and experiences, were not noted by scribes. Indeed, this analytical technique provides an empirical foundation upon which to more thoroughly explore not only the lives of those who could not read or write (or could afford to employ scribes to do so in their stead). It also provides a window for archaeologists to view, albeit abstractly, the daily lived experience of individuals from all segments of ancient Mesopotamian society (provided, of course, that skeletal remains are available for analysis). The introduction of such methods can only be a boon to Mesopotamian archaeology, especially with respect to the study of what might be termed “everyday” behaviors.

While the future for stable isotope analysis in Mesopotamian archaeology seems promising, it is important to remember that there are political and practical problems - such as legal or bureaucratic impediments to access skeletal collections - which must be negotiated in any study of this kind. Given these difficulties, I must add the caveat that some possible lines of research discussed here must remain, for the present, only as hypothetical possibilities, rather than concrete proposals for future projects. However, despite such setbacks, it seems to me that there are still a number of applications for the analysis of stable isotopes in Mesopotamian archaeology which are currently practicable, or will soon become practicable, thus rendering a discussion of such possibilities worthwhile. Awareness of these archaeological opportunities, and how best to exploit them, can only better prepare scholars as such potential projects arise.

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