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Differentiating mobility and migration in middle Holocene Cis-Baikal, Siberia

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ABSTRACT

The development of analytical techniques associated with individual life history approaches to reconstructing prehistoric patterns of diet and mobility has produced significant changes in the potential information contained within a single skeleton. In the context of Early Bronze Age hunter-gatherer groups in Cis-Baikal, Siberia, a comparison of bulk versus micro-sampling strategies has altered understanding of the level of mobility and interaction. Detailed surveys of biogeochemical variation in the landscape combined with improved resolution translate into an ability to examine the provenance and track the movements of an individual through different stages in their life. Determining where an individual was on the geographic landscape during multiple phases of life, as opposed to the geochemical landscape of childhood and death, is important to differentiating between patterns of migration and smaller scale movements undertaken during life. Advances in micro-sampling capabilities have enabled new sampling strategies that include the collection of data from multiple points on individual human teeth and bones. Micro-sampling of multiple skeletal elements expands the resolution with which researchers can examine an individual's life. Technical advances have also highlighted a need to re-examine the relationship between theoretical and analytical aspects of behavioral reconstructions in prehistory. Geochemical research in Cis-Baikal has closely followed advances in analytical capabilities and provides a case study to assess the efficacy of theoretical assumptions underlying explanations of short and long distance movements during lifetime and examine potential improvements in data interpretations.

1. Introduction

The use of biogeochemical analysis to reconstruct behavioral patterns has a long history in archaeology though the specific goals for using these data (e.g., health, diet, mobility) have varied. Studies initially focused on general nutrition and metabolic interactions with different elements and compounds, leading towards dietary reconstruction. Questions about mobility, interpreted as locale of birth versus adult life and subsequent death and burial, largely stemmed from the body of earlier paleodietary research that helped to elucidate which types of chemical analyses were likely to reflect intact information as opposed to variable metabolic functions or diagenesis. Metabolic functions can vary greatly throughout life (i.e., moderated by health, age, pregnancy, environment), or be influenced in the post-depositional environment, altering the chemical analytical results.

Early paleodietary research observed that strontium was a particularly useful element, commonly substituting for calcium within the hydroxyapatite in bone and teeth and comparatively resilient through life and subsequent burial (Comar et al., 1957; Comar and Wasserman, 1964; Elias et al., 1982; Likins et al., 1960; Nelson et al., 1986; Nelson and Sauer, 1984; Price et al., 1992; Rosenthal et al., 1972; Schroeder et al., 1972; Sillen and Kavanagh, 1982). The use of strontium isotopic and trace element analysis for studying movement was pioneered by ecologists mapping the geographical movement of different species and environmental materials (Gosz et al., 1983; Koch et al., 1992). This approach was adopted by archaeologists interested in prehistoric diet and mobility. The techniques have now been used by archaeologists for decades (e.g., Ericson, 1985, 1989; Ezzo et al., 1997; Grupe and Herrmann, 1988; Price, 1989; Price et al., 1994a; Price et al., 1994b; Sealy et al., 1995; Sealy, 1989; Sealy and Sillen, 1988), and have become routine parts of scientific analyses on archaeological skeletons.

There have been considerable refinements to the technical capabilities, applications, and interpretations over the years. For example, the transition from using TIMS to SM-MC-ICP-MS and finally to LA-MC-ICP-MS that resulted in reductions in pretreatment efforts and overall sampling times and costs, the tandem-use of multiple analytical techniques, and the integration of first multi-elemental sampling and ultimately micro-sampling of these multiple skeletal elements to produce a robust body of data to reconstruct individual life histories (Dolphin et al., 2012; Dolphin et al., 2003; Dolphin et al., 2016; Farell et al., 2013; Haverkort et al., 2008; Kang et al., 2004; Knudson and Price, 2007; Scharlotta et al., 2011; Scharlotta et al., 2013; Scharlotta and Weber, 2014; Weber et al., 2003; Weber and Goriunova, 2013). However, it is rare to see the progression of methodological development within a single region, even using materials from the same individuals and/

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or cemeteries (e.g., scale of analysis/sampling, destruction of samples, duration of life history elucidated, etc.) as has been possible with hunter-gatherers from Cis-Baikal, Siberia through the work of the Baikal Archaeology Project. In many ways the assumptions behind, and applications for, such analyses have changed significantly. It is not always clear that the full data potential of skeletal materials is being employed, raising doubts about the potential extent to which the analytical data can be extrapolated to behavioral patterns.

Many of the chemical analytical methods were developed and tested using sedentary populations of varying size in which differences of birth locality, status, and diet were anticipated. Difficulties can arise when transitioning to hunter-gatherer populations that vary throughout their lifetime and may not have distinctive markers of status in either their dietary makeup, or interred artifacts. For example: How effective are the established methods at analyzing movements when applied to populations with radically different behavioral patterns? Are we producing data that reflect changes during known time periods of a prehistoric lifetime? Does the data support generalizations on behavioral patterns that may not be temporally consistent or significant to the population being investigated? Are there any means to determine if technical and/or theoretical improvements can be made to better link the scale of behavioral patterns sought in the prehistoric record with the data being produced during analyses?

This discussion is based in a series of articles and book chapters produced over the last decade by the Baikal Archaeology Project (BAP) focusing on is the Cis-Baikal region of eastern Siberia (Haverkort et al., 2010; Haverkort et al., 2008; Scharlotta et al., 2013; Scharlotta and Weber, 2014; Weber and Goriunova, 2013; Weber et al., 2011). This research was produced in an environment of rapidly changing technical and theoretical discussions about how to address hunter-gatherer and mobility research. Within the region, the dominant geological formations roughly equate to cultural micro-regions that scholars have been investigating (Fig. 1). With cultural areas corresponding to geological differences, it was a promising landscape for geochemical research into patterns of movement and interaction throughout the region. The geochemical work has focused heavily on the Khuzhir-Nuge XIV cemetery in the Little Sea region (Fig. 2), with additional data from smaller cemeteries in the Little Sea and Upper Lena regions. More cemeteries are being analyzed to provide broader temporal and spatial coverage, but without the same type of overlap in research methods.

2. Concept of mobility

The common sense concept of mobility holds that people do not remain static in their environment under most conditions in human history. Mobility is defined as the quality of being mobile and thus the ability to move. The ability to move often includes the additional inference of being in motion, sequential movements having occurred, or the movement of people specifically. Indeed, individuals will always be mobile to a certain degree: fetching water, conducting hunting and gathering trips, traveling to tend to crops and/or herds, as residents of cities, traveling to their place of employment, or changing their social status. There is the implication that mobility, as the quality of being in motion, is taking place and can be observed and recorded to some measurable extent as having occurred. Part of the difficulty is that mobility is an active process, only observable in the present; whereas archaeologically, reconstruction of a series of movements that occurred in the past is required.

In attempts to describe mobility, having broad arbitrary categories, such as 'semi-sedentary,' can simplify explanatory efforts as researchers need only identify the appropriate category to place their archaeological materials. Yet, as noted by Kelly (1992, 1995: 159), 'it is not useful to think of mobility in terms of either a single dimension of group mobility or as a dichotomy of mobile versus sedentary (cf. Nicholas, 2007). There should be a straightforward relationship between the scale at which a movement occurred in time or space, the direct interactions between the person or object being moved, the surrounding environment, and how this will manifest as the result of observation or be reconstructed through analysis.

Mobility is effectively defined as the state (or capability) of being in motion, or not at rest. Motion, however, is the action or process of movement, traveling between a starting and ending point. Physical evidence that this action has occurred must either be directly observed as a witness to the process, inferred from observation that a change of location has occurred, or reconstructed following demonstration that an object is not characteristic of the local landscape or population and originated elsewhere. The type of evidence of interaction between a moving object and its surroundings is less clear and there can be a great deal of variability (e.g., trip length, duration) involved in the concept of mobility.

Sedentariness, or the time spent being sedentary, is a variable that can potentially be quantified and studied. This is the inversely related member of the same variable as mobility in that it aims to describe the time in which an object or person is not in motion. The evidence for sedentariness is rather more straightforward for it denotes the actual interaction between the person or object and its surroundings. Sedentariness can be defined as having limited or restricted mobility such that groups or individuals are effectively not mobile. Evidence for sedentariness is also expected to vary in relevant scales; for example evidence for contact with a certain food/water source, duration of seasonal habitation within a restricted geographical area, and chemical records of where an individual lived during different periods of their life. While more terminological accurate, general discussions about sedentism or sedentariness often refers to the length of time which settlements were inhabited and whether this suggests the use of stored resources, quite different than mobility researcher investigating disparities between the birth and death locale of local human or animal populations. Efforts to replace the term mobility in discussing the movements of within and between populations would likely cause confusion; rather the specific type of patterning in movement researchers are employing should be made clear.

Differentiating, or more clearly explaining, the different scales of movement and so related behavioral activities observed in the archaeological record is significant because physical mobility is the product of cultural structures and processes both directly and indirectly. Directly, through the necessary provisioning by group members of consumables, information and social ties, mobility patterning will be specific to given cultural groups and can elucidate behavioral trends changing through time or between different groups that may produce similar archaeological assemblages. Indirectly, however, mobility is somewhat more complex and potentially more informative on cultural patterns. Any individual has choices in their allocation of time and effort to various duties and functions deemed to be of importance to either the group or the individual. Thus, differences in patterns of action speak directly to the types of choices that were important to an individual or group and so were crucial to the structure of their lives. In regions such as Cis-Baikal (Weber and Bettinger, 2010; Weber et al., 2010; Weber et al., 2002) where genetically distinct populations employed different subsistence strategies and cultural manifestations within the same geographic area with similar environmental conditions, these decisions are important to explaining how and why the archaeological record is different for these groups.

Mobility patterning in the archaeological record is a group level phenomenon while the actual parts of the pattern are the individual actions. Patterns are viewed as the aggregate of individual mobility profiles that yield patterning at the group level susceptible to cultural transmission. Mobility as a sequence of movements will include a range of variability impacted by cultural structures. Variability in observed patterns reflects changes in the direct mobility, patterns of interaction with extant ecological conditions, dietary choices, kinship structures and other cultural traits.

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