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Mobility of middle Holocene foragers in the Cis-Baikal region, Siberia: Individual life history approach, strontium ratios, rare earth and trace elements

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ABSTRACT

Previous geochemical work conducted on the materials from the Khuzhir-Nuge XIV cemetery on Lake Baikal, Siberia, has demonstrated the effectiveness of using $^{87}Sr/^{86}Sr$ ratio analysis in interpreting mobility patterns among Early Bronze Age hunter–gatherer groups. The research reported here focuses on six small cemeteries representing the Little Sea and Upper Lena micro-regions as well the Early Neolithic (EN: ca. 8000–7200 cal BP) and Early Bronze Age (EBA: ca. 5200–3400 cal BP) periods, thus expanding both the geographic and chronological scope of the previous work. The reference collection of environmental samples, to document bioavailability of the measured geochemical tracers, was also expanded substantially by inclusion of samples of modern plants and water from Lake Baikal and a number of surrounding rivers. First, second, and third molars of 14 adult individuals were tested for $^{87}Sr/^{86}Sr$ ratios as well as rare earth and trace element concentrations using LA-ICP-MS. Each human tooth was micro-sampled at four locations along the crown enamel thus providing data of higher temporal resolution relative to a single sampling locus. Geochemical signatures for water, plant and animal bone samples were found to be far more variable across the region than predicted based on the age and type of geologic formations. $^{87}Sr/^{86}Sr$ ratios for cultural micro-regions proved to overlap significantly and required trace element data to identify more discrete geochemical groups. The level of hunter–gatherer mobility between and within the analyzed micro-regions was found to be significant with individuals recovered from the Upper Lena showing contact with the Little Sea micro-region along the northwest coast of the lake.

1. Introduction

Examination of strontium isotope ratios ($^{87}Sr/^{86}Sr$) in human and animal bones and teeth is a useful technique of gaining insights into migration and mobility patterns in past populations. Strontium isotope ratios broadly reflect the underlying bedrock geology, manifested in biologically available portions of the source materials (e.g., soils, plants, water, animals). Taken a step further, the question is whether a technique based roughly on differences between rather large geologic zones can be effective for tracking individual or group mobility on the landscape with resolution finer than migrations between such large areas. If so, such information would greatly benefit studies of prehistoric mobility, allowing for better informed discussions of where an individual came from and reaching beyond the question of whether they were born, lived and buried in the same locale.

The analysis of $^{87}Sr/^{86}Sr$ isotope systems in skeletal tissues, while from the geochemical perspective rather robust as a technique, is complicated in that the processes by which strontium is transferred first from the ground to the diet and then to the skeleton are susceptible to influence and alteration by even subtle changes in diet and localized mobility (Bentley, 2006). These concerns are potentially less significant in the context of agrarian populations, or even pastoral groups which follow relatively fixed annual cycles, than in hunter–gatherers that can potentially experience diverse physical mobility and multiple dietary changes over the period of a single or several years.

In the Cis-Baikal region of Siberia (Fig. 1), it has been hypothesized that hunter–gatherer groups formed centers with higher population densities near reliable food resources such as the productive fisheries on the Angara River and the Little Sea areas which

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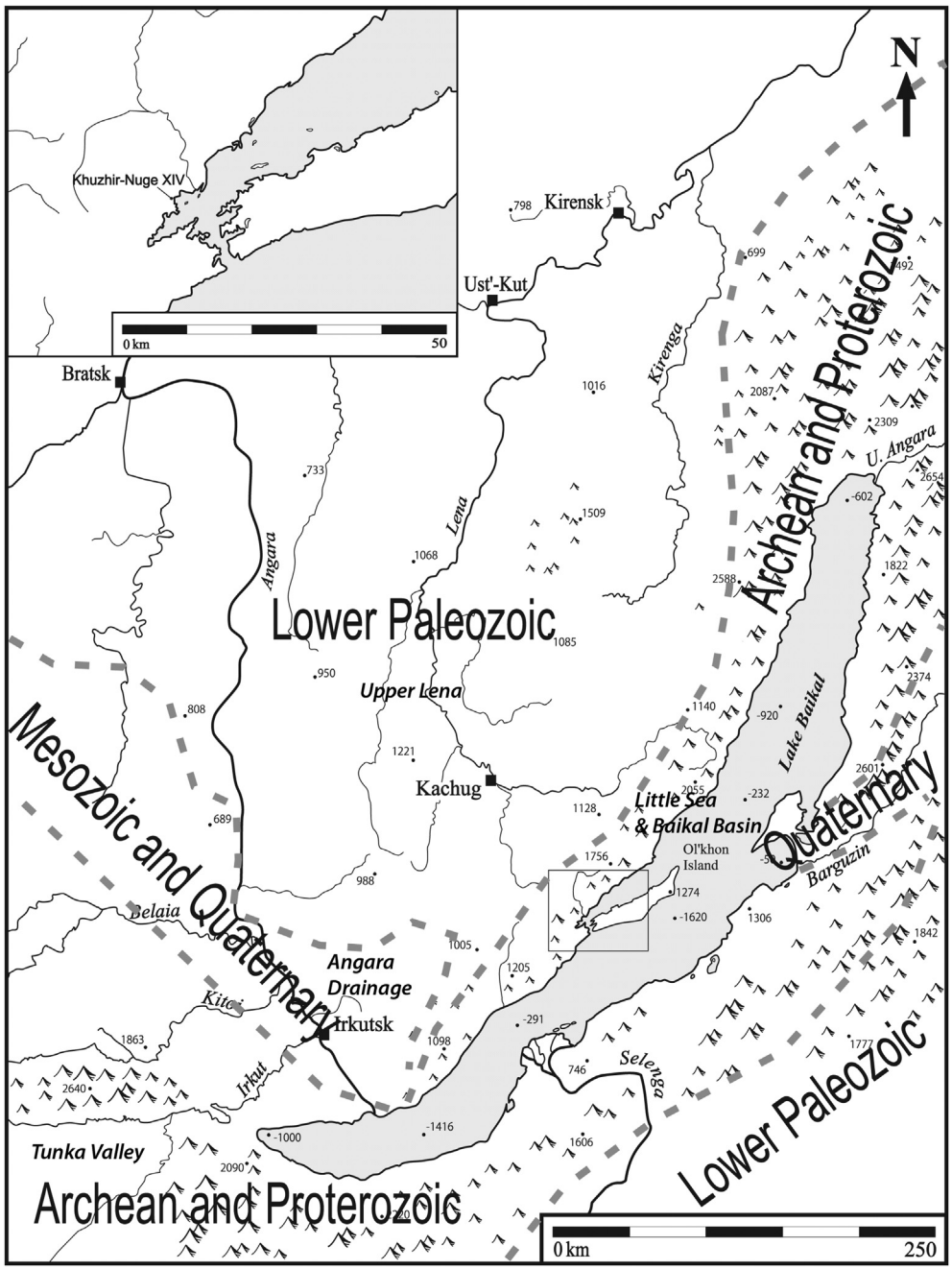

Fig. 1. Map of the Cis-Baikal region, Siberia, showing main geological formations, topography and archaeological micro-regions. Black dots with numbers indicate representative elevations (in m above sea level) and Lake Baikal water depths (in m below Lake Baikal level). Dotted grey lines denote the boundaries and ages of dominant bedrock geological formations, though also approximate cultural micro-regional boundaries.

feature a combination of riverine and cove-and-lagoon fishes, respectively. On the lake, the Baikal seal would be available in late winter to early spring pretty much everywhere along the open coast (Weber et al., 2011). It appears that the mobility of such groups was largely limited to those relatively small areas or micro-regions. Relocation of individuals between micro-regions took place as well but in a fashion that appeared to be somewhat asymmetrical: some micro-regions attracting more individuals than others. These insights come from examination of $^{87}Sr/^{86}Sr$ values as well as carbon and nitrogen stable isotope signatures in a few large Neolithic and Early Bronze Age (EBA) cemeteries in the Little Sea micro-region of Baikal (Khuzhir-Nuge XIV and Kurma XI), in the Angara valley (Lokomotiv and Ust'-Ida), the Shamanka II cemetery on the southwest coast of Baikal, and several other small cemeteries scattered around entire Cis-Baikal (Weber et al., 2011).

The current study focuses on mapping the distribution of the biologically available $^{87}Sr/^{86}Sr$ ratios and rare earth and trace element concentrations throughout much of the Cis-Baikal region and on examination of these geochemical tracers in 14 foragers represented by molar samples recovered from several small cemeteries (Table 1). First, second, and third molars of 14 adult individuals were tested for $^{87}Sr/^{86}Sr$ ratios well as rare earth and trace

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