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Y-chromosomal DNA analyzed for four prehistoric cemeteries from Cis-Baikal, Siberia

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ABSTRACT

The Lake Baikal region of Siberia was home to two temporally distinct populations from Early Neolithic, EN (*7500–7000 cal BP*) to Late Neolithic-Early Bronze Age, LN-EBA (*5570–3725 cal BP*). The EN group was separated from the LN-EBA group by a ~1500-year gap (hiatus), and during this hiatus no human remains have been recovered from the Lake Baikal area. Examination of the paternal lineage through Y-chromosomal polymorphisms is a novel approach to BAP and will facilitate the assessment of the paternal continuities and/or discontinuities within and between the EN and the LN-EBA groups, and complement the previously examined maternal data. Several new ancient DNA extraction and PCR amplification techniques were optimized to address the technical challenges during sample analysis. Each sample was extracted twice in duplicate on different occasions to authenticate the results. Thirteen Y-chromosomal Single Nucleotide Polymorphism (SNP) markers were examined via the SNaPshot multiplex PCR reaction to determine Y-chromosomal haplogroups of males. Results have been obtained from 16 males from the EN cemeteries Lokomotiv and Shamanka II representing haplogroups K, R1a1 and C3, and 20 males from the LN-EBA Ust'-Ida and Kurma XI cemeteries representing haplogroups Q, K and unidentified SNP (L914). For those males belonging to haplogroup Q, further experiments were obtained to examine sub-haplogroups of Q, and the results showed that those males belong to sub-haplogroup Q1a3. The paternal Y-chromosome results suggest a discontinuity between the EN and LN-EBA populations. The significance of this research lies on the utility of DNA analysis in making inferences about the pre-historic social structure.

1. Introduction

1.1. Background

Archaeological data indicate that the Cis-Baikal region of Siberia is the site of several large prehistoric cemeteries since the Early Upper Paleolithic period (Weber, 1995; Goebel, 1999). The Cis-Baikal area has four main micro-regions: the Angara River Valley, the upper Lena River Valley, the Little Sea (Ol'khon) on the northwest coast of Lake Baikal, and the South Baikal region (Fig. 1). The four micro-regions have been investigated by several Russian and Canadian scholars since 1990. The Baikal Archaeology Project (BAP), an international multidisciplinary initiative, aims to reconstruct the lifestyle of the hunter-gatherer groups inhabiting the area and buried in formal cemeteries during the Neolithic and Bronze Age periods. The area was home to two temporally distinct populations from Early Neolithic (EN) (Kitoi culture), *7500–7000 cal BP*, to Late Neolithic-Early Bronze Age (LN-EBA) (Serovo-Isakovo-Glazkovo culture), *5570–3725 cal BP*. Dates were acquired via radiocarbon dating. The EN group was separated from the LN-EBA group by a ~1500-year gap (hiatus) during which large mortuary sites are entirely absent (Weber et al., 2016).

Both the EN (Kitoi) and the LN-EBA (Serovo-Isakovo-Glazkovo) cultures had formal cemeteries, an area used repeatedly and more or less exclusively for disposal of the dead (e.g. (Goldstein, 1981)).

Earlier Russian craniometric studies suggested that the EN and the LN-EBA populations are genetically distinct (Gerasimova, 1992; Mamonova, 1973; Mamonova, 1980; Mamonova, 1983). Measuring the biological differentiation between the two cultures can also be achieved through their genetic signatures, which would give a strong verification of the genetic relationships between them.

Ancient DNA (aDNA) research of several hunter-gatherer individuals from Cis-Baikal was first conducted by Russian researchers analyzing mitochondrial DNA (mtDNA) composition (Naumova et al., 1997; Naumova and Rychkov, 1998). Ancient DNA analysis was continued by several researchers, who examined mtDNA polymorphisms of skeletal samples from different mortuary sites. These mortuary sites include Lokomotiv (EN cemetery) and Ust'-Ida (LN-EBA cemetery) (Mooder, 2004), Shamanka II (EN cemetery) (Thomson, 2006) and Khuzhir-Nuge XIV (LN-EBA cemetery) (Gustafson, 2007). Unfortunately,

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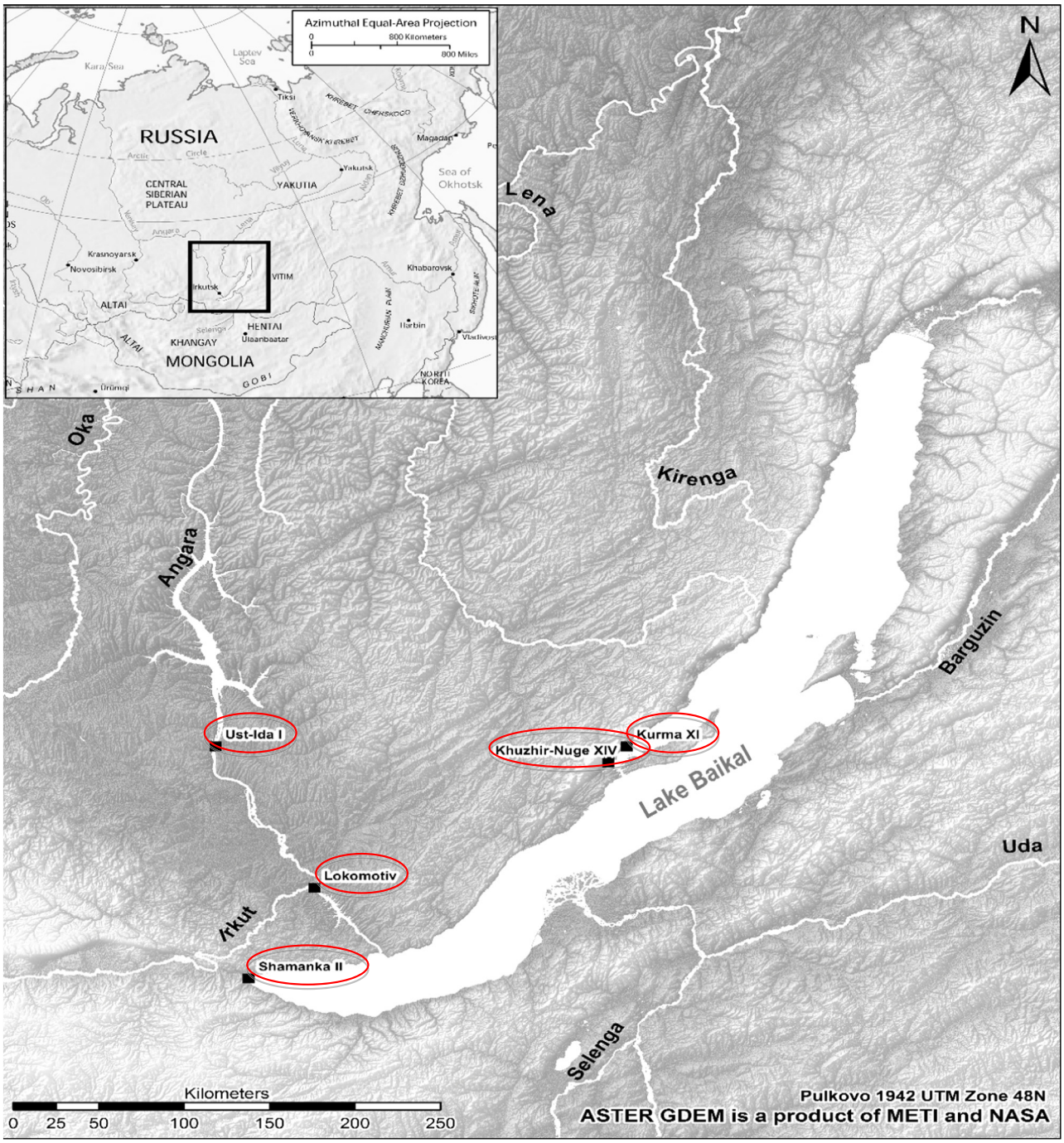

Fig. 1. Cis-Baikal cemeteries' and their locations-circled in red (Shamanka II and Lokomotiv-EN) and (Ust'-Ida, Khuzhir-Nuge XIV and Kurma XI-LN-EBA) (Lieverse et al., 2014). Source: Adapted with permission from [Point taken: An unusual case of incisor agenesis and mandibular trauma in Early Bronze Age Siberia. A.R. Lieverse, I.V. Pratt, R.J. Schulting, D.M.L. Cooper, V.I. Bazaliiskii, A.W. Weber. International Journal of Paleopathology. 6. Copyright© 2014 Elsevier] (License number 3571161002487).

samples from Khuzhir-Nuge XIV, located on the Little Sea micro-region, were poorly preserved and mtDNA analysis was not possible.

No Y-chromosomal analyses were obtained previously on any of Lake Baikal's cemeteries.

1.2. Archaeological context

As a part of the archaeological research, estimation of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope signatures in human bone is considered the most direct and reliable method to determine diet and subsistence strategies of prehistoric populations (Katzenberg, 2008). In BAP, the values of $\delta^{13}C$ and $\delta^{15}N$ isotopes from the individuals' osteological remains were compared to $\delta^{13}C$ and $\delta^{15}N$ isotopes' ratios of local fauna in different Cis-Baikal micro-regions to create a thorough descriptive reconstruction of prehistoric populations' diet and subsistence practices since the EN period to the LN-EBA period (Weber and Bettinger, 2010; Katzenberg and Weber, 1999; Katzenberg et al., 2010). Examination of different samples from Cis-Baikal micro-regions and the different periods provided clear evidence for the consumption of freshwater foods (e.g. fish and seal) in groups from Lake Baikal (Weber and Bettinger, 2010).