

Chronology of middle Holocene hunter–gatherers in the Cis-Baikal region of Siberia:
Corrections based on examination of the freshwater reservoir effect.

For *Quaternary International*

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ABSTRACT

A dataset of 256 AMS radiocarbon dates on human skeletal remains from middle Holocene cemeteries in the Cis-Baikal region, Siberia, and associated carbon and nitrogen stable isotope values are analyzed for new insights about culture history and processes of culture change. First, based on the typological criteria all dated human burials are assigned to mortuary traditions and typo-chronological units—Late Mesolithic, Early Neolithic, Late Neolithic and Early Bronze Age. Next, all dates are corrected for the Freshwater Reservoir Effect (FRE) according to the regression equations developed using paired radiocarbon dates on human and terrestrial faunal remains from the same graves (Bronk Ramsey *et al.*, 2014; Schulting *et al.*, 2014; 2015) and examined for chronological trends using a Bayesian approach. While the entire corrected culture historical sequence is younger by roughly 200–400 years relative to the previous model (Weber *et al.*, 2010) the shift of the specific period boundaries is not systematic due to the varying proportion of aquatic food in the diets of the relevant groups. Examination of the dataset subdivided into smaller spatio-temporal units provides additional insights. During the Early Neolithic, in the Angara and Southwest Baikal micro-regions there is a chronological trend toward increased reliance on aquatic food. During the Early Bronze Age in the Little Sea micro-

region, there appears to be a trend toward increased reliance on the Baikal seal. This shift, however, can also be interpreted as increasing migration over time of new groups from the Upper Lena. The sample from the Early Neolithic Shamanka II cemetery in Southwest Baikal shows two non-abutting phases of use each displaying a trend toward greater consumption of aquatic foods. These findings provide new chronological framework for the study of other cultural changes affecting middle Holocene hunter–gatherers in the region. The results may also allow better correlation with other sequences, cultural and environmental, that are not affected by the FRE.

1. INTRODUCTION

Middle Holocene prehistory of the Cis-Baikal region in East Siberia (Fig. 1) belongs to one of the many cases around the world where examination of materials from mortuary sites has dominated archaeological research. Grave goods and human skeletal remains have been the focus of many studies essentially since the beginning of professional archaeology in the region. Although much has been written about culture history and cultural and biological variation among these groups, many questions regarding the processes of culture change still remain unanswered (e.g., Weber and Bettinger, 2010; Weber *et al.*, 2011). The explicit emphasis on mortuary sites also created an imbalance with regard to dating, both typological and chronometric, as well as the cultural characterization of the different periods and micro-regions. The periods with well-documented cemeteries naturally have been given much attention with many attempts to define them in cultural and chronological terms. In contrast, the periods without cemeteries (e.g., Middle Neolithic and, to a lesser extent, Late Bronze Age) have received much less attention and their cultural characteristics and temporal boundaries remain vague.

Middle Holocene prehistory of Cis-Baikal is also interesting in that it has seen a long debate about its chronology and experienced several fundamental revisions to its culture history (cf. Weber, 1995 for review). To keep the matter brief, the first relatively well-documented model of continuous progression of hunter–gatherer cultures or stages (Khin’–Isakovo–Serovo–Kitoi–Glazkovo–Shivera; Okladnikov 1950) was criticized by many Siberian scholars and eventually fell apart under the weight of radiocarbon evidence (Konopatskii, 1982; Mamonova and Sulerzhitskii, 1989; Weber, 1995); however, the names of the relevant mortuary traditions are in use to this day without many revisions. According to the new chronological evidence, the Kitoi mortuary tradition is much older than Isakovo and Serovo, which, in turn, appear to be chronologically parallel. The Glazkovo and Shivera traditions, whose typo-chronological placement was based on the presence of copper and bronze objects, retain their original position at the end of the sequence. A few dates appeared to be quite old, perhaps representing the Late Mesolithic Khin’ tradition in the Okladnikov model, but they were either subject to very large measurement errors or their archaeological context was compromised, thus raising doubts about the general archaeological identity of this early mortuary tradition (Weber *et al.*, 2010).

Further reassessments of this initial radiocarbon evidence and the subsequent accumulation of a much larger set of dates by the Baikal Archaeology Project confirmed the main points of the new culture history model but also led to some revisions (Weber, 1995; Weber *et al.*, 2002, 2006, 2010; Weber and Bettinger, 2010: Table 1). The most important of these was the identification of a roughly millennium-long period with no formal cemeteries at all, thus breaking the chronological continuity of Neolithic mortuary traditions (Weber *et al.*, 2010; Weber and Bettinger, 2010):

<i>Period</i>	<i>Mortuary tradition(s)</i>	<i>Cal BP years</i>
Late Mesolithic (LM)	Lack of archaeologically visible mortuary sites	8800–8000
Early Neolithic (EN)	Kitoi and other micro-regionally specific traditions	8000–7000/6800
Middle Neolithic (MN)	Lack of archaeologically visible mortuary sites	700/6800–6000/5800
Late Neolithic (LN)	Isakovo and Serovo	6000/5800–5200
Early Bronze Age (EBA)	Glazkovo	5200/5000–3400

Following the long-standing Russian school of archaeology, Cis-Baikal’s hunter-gatherer culture history is defined on the basis of technological criteria. Thus, changes in the stone industry (i.e., mostly proliferation of the microlithic technique) define the Mesolithic, the bow and arrow, ground stone tools, and ceramics identify the Neolithic, and objects of copper and bronze the Bronze Age. Further divisions within Neolithic are based mainly on the characteristics of the mortuary protocol (see below for more detail) while within the Bronze Age on the appearance of new forms of metal artefacts. Since animal and plant domesticates were introduced into the region only during the Iron Age and historical times, respectively, subsistence of all preceding groups was based on various combinations of game and seal hunting, fishing and gathering.

The work reported in this paper represents the next step in the revisions to the middle Holocene culture history in Cis-Baikal. While the changes may at first appear as less dramatic than those associated with earlier applications of radiocarbon dating in the region, it will become evident later in the paper that they are perhaps even more important. The matter regards corrections based on the identification of a Freshwater Reservoir Effect (FRE) impacting the radiocarbon ages of human skeletal remains on which our understanding of the culture history and process of middle Holocene Cis-Baikal relies to a substantial extent.

While the marine reservoir effect has been known for some time and from many archaeological and environmental settings around the world, the importance and complexity of the FRE has been only recently recognized (e.g., Ascough *et al.*, 2012; Cook *et al.*, 2001; Lillie *et al.*, 2009; Olsen *et al.*, 2010; Higham *et al.*, 2010; Wood *et al.*, 2013). Its presence suspected for some time (e.g., Prokopenko *et al.*, 1999), a FRE has also been confirmed in the aquatic system of Lake Baikal based on the comparison between dates obtained on bones from terrestrial herbivores and the Baikal seal representing the same stratigraphic units at the multilayered archaeological campsite Sagan-Zaba II on Lake Baikal (Nomokonova *et al.*, 2013). Since the diets of middle Holocene foragers in the region included spatially and temporally variable

amounts and kinds of aquatic foods (Weber *et al.*, 2011), radiocarbon determinations made on human skeletal remains are likely to overestimate their true age to correspondingly variable degrees. To assess the extent of FRE impact on the radiocarbon age of human osteological remains, paired dating of human and animal terrestrial herbivore skeletal material from the same grave was implemented (Bronk Ramsey *et al.*, 2014; Schulting *et al.*, 2014; 2015). Separate correction equations were developed for the entire Cis-Baikal region as well as for its constituent micro-regions: the Angara River combined with Southwest Baikal, the Little Sea area and the Upper Lena (Fig. 1).

The primary goal of this paper is a preliminary assessment of the revisions to the regional culture history resulting from the corrections to the ^{14}C -dates available for middle Holocene hunter-gatherers from Cis-Baikal. An investigation of temporal dietary trends is our secondary goal. After these introductory notes, we present the available set of radiocarbon dates generated for Cis-Baikal and review the principles of typological dating of Cis-Baikal mortuary assemblages. We follow with the introduction of the FRE correction equations used in the paper and explain the methods of analysis. The discussion of the results is divided into two parts. Part one is an assessment of Cis-Baikal middle Holocene culture history as a whole and part two is organized by micro-regions, where more specific chronological patterns are examined. The paper ends with a summary of the findings and a number of conclusions of broader archaeological relevance.

2. MATERIALS

The study is based on radiocarbon dates obtained for 256 individuals from the Cis-Baikal region. All dating was conducted at the Oxford Radiocarbon Accelerator Unit (ORAU) at the University of Oxford, UK, with stable carbon and nitrogen isotope ratios, collagen yields and C/N ratios reported at the same time (Fig. 2, Supplement 1). Analytical precision for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ is ± 0.2 and $\pm 0.3\text{‰}$, respectively. With the exception of the 48 dates included in the paired dating project (Bronk Ramsey *et al.*, 2014; Schulting *et al.*, 2014; 2015) and some reported in the monograph of the Kurma XI cemetery on Lake Baikal (Weber, 2012), the ORAU data have not yet been published. Prior to the dating program implemented at ORAU, 335 radiocarbon dates (with some overlap with ORAU) were undertaken at the Isotracer Laboratory, the University of Toronto, Canada, while carbon and nitrogen stable isotopes for the same individuals were analyzed by Dr. M.A. Katzenberg at the University of Calgary (Weber *et al.*, 2006; 2011). Although Isotracer did not provide stable isotope measurements, it would still be possible to correct these dates for the FRE using the stable isotope results from Calgary, enabling their inclusion in the analysis alongside the ORAU dates and thus making the dataset substantially larger. Aside from some additional difficulties related to the fact that in a number of instances different skeletal elements were tested in the labs, the main problem is that the ORAU and Isotracer dates appear to be incompatible. For example, for the EN Shamanka II cemetery on Southwest Baikal, there are currently four individuals (Burials No. 16, 24.02, 30 and 32) dated at both laboratories (Supplement 1; Weber *et al.*, 2006: Table 2) but in no case do these pairs pass the χ^2 test of the

R_Combine function in OxCal 4.2.4 (Ward and Wilson, 1978). In every instance the Isotrace date is significantly younger than the ORAU measurement. This difference may relate to the improved removal of contaminants provided by the use of 30 kD ultra-filters at Oxford (Brock *et al.*, 2010). As all Shamanka II individuals dated at Isotrace have been since reanalyzed at ORAU, the Isotrace dates are omitted from analysis.

There are around 200 individuals from a number of cemeteries across the entire region without an ORAU date but readily available for analysis. The majority derive from the following cemeteries: EN Lokomotiv, the LN and EBA components of Ust'-Ida I—both in the Angara valley, and EBA Khuzhir-Nuge XIV in the Little Sea micro-region. Furthermore, there are still many skeletons from the older excavations along the Angara and Upper Lena Rivers (Okladnikov, 1974; 1975; 1976; 1978; Svinin, 1981) and in the Little Sea (Masson, 1991); however, at present, their number is difficult to assess. While a few of these sites have been dated at ORAU to some extent, plans to analyze the remaining extant individuals are under development. In addition, some 45 individuals from Shamanka II are also still without a date.

3. TYPOLOGICAL DATING

The matter of typological dating of the relevant mortuary traditions requires some attention. The substantial body of data provided by approximately 184 cemeteries, 1026 graves and 1182 individuals (Weber and Bettinger, 2010: Table 3), relatively well-documented in various publications and reports, and the equally substantial amount of regional and micro-regional variation in mortuary characteristics, make the typological classification of Baikal's middle Holocene mortuary assemblages a relatively complex exercise (Bazaliiskii, 2010; Weber and Bettinger, 2010). Unsurprisingly perhaps, this material has never been systematically analyzed as a whole and doing so would be beyond the scope of this study. Consequently, it is not possible to provide a complete list of traits defining relevant chronological and territorial groups nor is it possible to give new quantitative results regarding geographic distribution and prevalence of these traits based on the entire corpus. Instead, what follows is a summary of several standard diagnostic characteristics as per the available literature. Unfortunately, quantitative evidence to support many of these claims is sparse. When practical, similarities and differences between the micro-regions as well as exceptions to general patterns are noted.

3.1. Late Mesolithic

Okladnikov originally assigned the Khin' mortuary tradition to the Mesolithic (Okladnikov, 1950). Represented in his dataset by two graves (Pad' Khin'skaia and Pad' Chastye) excavated in the Angara valley in the 1930s, subsequent fieldwork has produced only two additional graves, one each in the Angara (Ust'-Griaznaia) and the Upper Lena valleys (Rytvinka), matching the typological criteria of the Khin' mortuary protocol (Bazaliiskii, 2010). Grave No. 8 from Lokomotiv-Raisovet is excluded as its initial assignment to the LM was based not on the typological characteristics but rather on the radiocarbon date (Bazaliiskii, 2010; Weber *et al.*, 2006) which we now know was affected by the FRE. A dozen or so other graves from several

cemeteries across much of Cis-Baikal have been recently assigned by Bazaliiskii (2010) to the Final Mesolithic based on a combination of typological and radiocarbon criteria. Since both groups are not very numerous to begin with and, furthermore, represented in this study by even smaller number of dated burials, they are treated here as one Late Mesolithic typo-chronological group.

The Late Mesolithic mortuary tradition appears highly variable. Body position is mostly flexed while extended burials have been observed only in a few cases, the orientation is to N, NW, or E, use of red ochre ranges from isolated spots to full coverage (e.g., Khotoruk), and grave goods are generally small in number but relatively diverse. Grave accoutrements show similarities with the Mesolithic (prismatic blades and points on prismatic blades) and the EN (fishing tackle including mostly fishhook shanks but also a barb and a leister). Ornaments are not common and when they do occur there are beads, red deer canine pendants and a boar tusk pendant—the kinds known also from EN, LN and EBA graves. Bazaliiskii (2010) defines these graves in terms of the absence of pottery and bifacially formed arrowheads but, to be sure, many other categories relatively frequent among EN, LN, and EBA graves are lacking too (e.g., green or white nephrite tools and ornaments, composite tools, bone points, etc.)

3.2. Early Neolithic

The Kitoi mortuary tradition is known primarily from a few large cemeteries located in the Angara valley (Lokomotiv, Kitoi, Galashikha, and Ust'-Belaia) and one (Shamanka II) on the southwest tip of Lake Baikal as well as from a number of isolated graves scattered along the banks of the Angara river (Fig. 1; Bazaliiskii, 2010). The ubiquitous use of copious amounts of red ochre is perhaps the most distinctive mortuary characteristic of this tradition. According to Bazaliiskii (2010), in the Angara valley 96% of Kitoi graves show this trait. Additionally, body position is predominantly extended, but flexed or bundled burials occur occasionally, and there are a few prone interments. The head is generally oriented to the north, graves with more than one interment are common and in many such cases the burials are arranged head-to-toe and on different stratigraphic levels, suggesting successive interments. Some burials have missing skulls and graves generally lack stone structures.

Grave goods are the most variable in kind and number of all middle Holocene mortuary traditions documented in the region, featuring as many as 60–65 categories (Bazaliiskii, 2010). Most common are composite lithic fishhook shanks and bifacial arrowheads but many other kinds are well-represented, including an array of stone, bone and antler tools (unilateral harpoons and a range of points and shafts or handles of composite tools), objects made of green nephrite (knives and adzes), ornaments (rings, beads, red deer canine pendants, bone pendants, mother-of-pearl pendants and boar tusk pendants) and objects of zoomorphic art depicting terrestrial (moose) and aquatic fauna (fish and seal). Pottery is very rare; however, when it does occur, complete mitre-shaped pots with net impressions on the outside surface are found. Within any given cemetery, the distribution of these diverse grave goods is highly variable: some burials are accompanied by hundreds of items while many others have very few or none at all.

Outside of the Angara valley and Southwest Baikal, the EN graves are best characterized as displaying variants of the ‘classic’ Kitoi package: a small number of Kitoi traits might be present but others are lacking. Furthermore, other traits usually show little patterning making it difficult to present this variation in a systematic way. Since Bazaliiskii (2010) and Weber and Bettinger (2010) have discussed the matter in detail, we can limit ourselves to a few examples. At Fofanovo, on the lower Selenga River, all graves have copious amounts of red ochre but the bodies display flexed legs and southeast orientation of the head and the composite fishhooks of the Kitoi type are absent (Gerasimov and Chernykh, 1975; Bazaliiskii, 2010). At Kurma XI in the Little Sea micro-region, all burials have the N orientation and some show red ochre but the grave good assemblage—a total of five prismatic blades from six graves—is clearly not EN but rather Mesolithic in character (Weber *et al.*, 2012). However, such lithics would not be out of place as part of a larger EN, LN or even EBA mortuary assemblage. At Khotoruk, in the same micro-region, all graves have red ochre and the burials show the N orientation but the body position is flexed. Only one grave has fishhooks, there are no bifacial arrowheads and the remaining grave goods are not particularly diagnostic. The same situation, i.e., the lack of pattern, prevails on the Upper Lena, where every cemetery classified as EN seems to be different from the other one, and, of course, from the Angara and Little Sea micro-regions. Here, ironically, it is the Turuka cemetery near Ust’-Kut in the north, geographically the most distant from the ‘classic’ Kitoi, that shows most resemblances to it (Fig. 1; Bazaliiskii and Ineshin, 1995; Bazaliiskii, 2010). For the record, a few seemingly Kitoi graves in the Angara valley pose similar classificatory ambiguities (Bazaliiskii, 2010).

This lack of clear pattern, of course, causes difficulties and disagreements about chronological classification of this group of graves. The presence of, for example, composite fishhooks or red ochre may be sufficient to place them in the EN; however, it is also possible to place more emphasis on the differences than the similarities and assign them to the LM. For example, Khotoruk has been placed in the Final Mesolithic by Bazaliiskii (2010), but in the EN by Konopatskii (1982). Weber *et al.* (2012) classified such graves from Kurma XI as EN, though based on Bazaliiskii’s criteria they should rather belong to the LM.

3.3. Middle Neolithic

Since the reassignment of the Serovo graves—MN in Okladnikov’s model (1950)—to the LN at the turn of the last century (Mamonova and Sulerzhitskii, 1989; Weber, 1995; Weber *et al.*, 2002, 2006), there is currently no other archaeologically visible mortuary tradition associated with this period. Consequently, the MN is frequently referred to as representing a discontinuity in the use of formal cemeteries in the region.

3.4. Late Neolithic

Two main mortuary traditions have been proposed for the LN: Isakovo and Serovo, both first described by Okladnikov (1950). Okladnikov dated Isakovo to the EN and Serovo to the MN but since the introduction of radiocarbon dating, the consensus has been that both belong to the same

LN period (Mamonova and Sulerzhitskii, 1989; Weber, 1995; Bazaliiskii, 2010; Weber and Bettinger, 2010). In the Angara valley, Isakovo and Serovo graves co-exist at many cemeteries (e.g., Serovo, Ponomarevo, and Bratsk). Okladnikov (1978) and, more recently, Bazaliiskii (2010) proposed a local version of the Serovo mortuary protocol for the Upper Lena micro-region, referring to it as Archaic or Verkholsk, respectively. Bazaliiskii (2010) also identifies a separate Serovo group in the Little Sea micro-region. It seems, however, that the range of similarities and differences displayed by Serovo graves in these three micro-regions fully warrants their combined treatment, a decision that has limited impact on this study because, for the reasons discussed below, EN and LN dates from the Upper Lena are excluded from analysis.

The Isakovo mortuary tradition was identified by Okladnikov (1950) on the basis of 12 graves only, all from the Angara valley. Subsequent fieldwork has substantially expanded the body of data, mostly in terms of the number of sites and graves but much less in geographic distribution. Today, the Isakovo mortuary tradition is still known exclusively from the Angara valley. Isakovo graves feature surface stone structures, orientation parallel to the Angara River with the heads pointing upstream (generally S). Most graves are single inhumations but multiple interments are not uncommon. Subadult individuals account for an unusually large proportion of all burials (Bazaliiskii, 2010).

Grave inclusions are less diverse in the Isakovo than in the Kitoi mortuary tradition, with 20–25 categories represented (Bazaliiskii 2010). Mitre-shaped clay vessels with net impressions and round pits along the rims, recorded in 70% of graves, are among the most ubiquitous grave goods. Other frequently found objects include a range of bone and antler points, bone or antler shafts of double-sided composite tools (daggers and spears) and harpoons. Large lithic bifaces, common in the Serovo mortuary protocol, have been found only in three Isakovo graves. Fishing gear is rare and so are objects of art, with only a few anthropomorphic items known. Overall, Okladnikov's original portrayal of this mortuary tradition as displaying little variation in terms of grave architecture, body treatment and kind and number of grave goods seems to hold as much today as it did then.

The Serovo tradition is known from the Angara, Little Sea and Upper Lena micro-regions and this broad geographic distribution subsumes variation with regard to many aspects of the mortuary protocol. On the Angara, burials are in extended supine position, perpendicular to the river with the head pointing away from it. It is this referencing relative to the river that sets Serovo fundamentally apart from Isakovo. On the Angara, Serovo graves feature stone structures both on the surface as well as in grave pits. Red ochre is relatively frequent but its use is limited to small and isolated patches. Most graves have single interments and grave goods are more numerous and more variable than in the Isakovo tradition, with 30–35 categories of grave goods (Bazaliiskii 2010). Stone, bone and antler tools, and pottery are among the most common. In the Angara valley, egg-shaped pots, invariably present in all Serovo graves, and large bifacially formed points (spearheads) also distinguish Serovo assemblages from other mortuary traditions in this micro-region. Two-sided composite inset points differ morphologically from Isakovo points, but fishing gear, featured by several bone and antler harpoons and two stone fish-lures,

does not and is equally rare. Portable art, represented by single examples of anthropomorphic and zoomorphic figurines, and a few unique bird carvings, is also rare. Graves with rich grave good assemblages are apparently more common than in the Isakovo tradition.

With a few exceptions, much of the Angara Serovo pattern is repeated in the Little Sea and on the Upper Lena (Bazaliiskii, 2010). Grave architecture, use of ochre, number of individuals per grave, body position, and orientation relative to water are similar in all three micro-regions, although in the Little Sea water referencing may lead to confusion. Due to the geographic orientation of the lake's coastline, the placement of the deceased's head away from Baikal in many instances effects the N orientation of the interments, the same as in EN burials. In absence of other diagnostic traits (and ^{14}C dating), this creates ambiguity and potential for misclassification.

Further, many burials on the Upper Lena and in the Little Sea are covered or wrapped in birch bark and many skeletons are affected by fires set inside grave pits. Fishing tackle is rare in the Little Sea and slightly more frequent on the Upper Lena. In the Little Sea clay vessels are quite common (31 pots in 19 graves) and they appear to be of the egg-shape form. On the Upper Lena, however, clay vessels—mitre-shaped as the Isakovo pots on the Angara—have been found in only about 50% of the graves (Bazaliiskii, 2010). Ground stone adzes or axes and composite knives are also typologically similar to the specimens found in Isakovo graves. Antler picks appear to be documented so far only on the Upper Lena while grave goods from the Little Sea do not show any specifically local characteristics.

3.5. Early Bronze Age

Currently, the Glazkovo mortuary tradition is the only one that is known from all four micro-regions (Okladnikov, 1955; Svinin, 1981; Konopatskii 1982; Weber *et al.*, 1995; Kharinskii and Sosnovskaia 2000; Goriunova, 2002; Turkin and Kharinskii, 2004; Weber *et al.*, 2008; Goriunova and Novikov, 2010; Weber *et al.*, 2012). Although on the regional scale, and to an extent also micro-regionally, it displays relatively substantial variation in terms of presence and absence of various mortuary characteristics, for the purpose of this study it is not necessary to analyze the Glazkovo tradition in such detail. Copper and bronze objects define the chronological placement of this group relative to the others, but since metals are generally quite rare, it is primarily the orientation of graves and burials that sets Glazkovo apart. Although variable between the micro-regions, these two characteristics work well within each area. On the Angara, Glazkovo graves, like the LN Isakovo, are parallel to the Angara but the heads are oriented downstream (generally N), that is, in the opposite direction than seen in the Isakovo. In the Upper Lena micro-region Glazkovo graves are parallel to the rivers but since they flow in different directions, the orientation of the Glazkovo burials relative to cardinal directions naturally differs. In the Little Sea, where there is no large river and the coastline is quite irregular, referencing relative to water does not work in the same way but the graves are typically oriented along the SW–NE axis (generally parallel to the long axis of Baikal) with heads pointing SW.

On Southwest Baikal, Glazkovo graves are known so far from only one cemetery, Shamanka II. Here, to complicate matters further, the graves are oriented N–S or NW–SE with the heads pointing N or NW and, so it seems, the water-referencing rule does not apply. In this area, which lacks a large river, the lake’s coast runs in various directions as it curves around its southwest end. Fortunately, due to the obvious differences regarding other aspects of the mortuary protocol, mainly the profuse use of red ochre, it is difficult to confuse EBA with Kitoi graves, numerically the dominant component at Shamanka II. At Fofanovo, on the lower Selenga, Glazkovo graves, like on the Angara, are also parallel to the river, but the heads point E thus upstream rather than downstream as on the Angara (Gerasimov and Chernykh, 1975).

Such characteristics as grave architecture (i.e., use of stones), number of interments per grave (predominantly one), and body position are similar in all four micro-regions and are also similar to Isakovo and Serovo groups. Red ochre occurs rarely, mostly, as in the LN, in isolated spots, but in the Little Sea there are a few burials entirely covered by this pigment (e.g., Graves 14 and 17 at Kurma XI; Weber *et al.*, 2012). Also in the Little Sea, many graves have been disturbed in the past and many skeletons are charred from fires set inside grave pits. Assortment of grave goods, by and large, repeats many categories found in LN Isakovo and Serovo graves but differ from them in detail (adzes and axes, composite tools, harpoons, bone points, arrowheads, bifaces, etc.). New, or at least much more common than earlier, are objects made of white nephrite (disks and rings) but artefacts made of green nephrite also occur. Entirely new are the seated burials and, of course, the metals. Utilitarian objects (e.g., knives, needles and fishhooks) are the most common but ornaments, mostly rings, or other kinds such as the unique medallion from Grave 1 at Kurma XI (Weber *et al.*, 2012: Photos 17 and 22) are known too. Clay pots are rare and fishing gear (fishhook shanks and barbs and harpoons) is even less common. Such non-diagnostic ornaments as boar tusk pendants, red deer canine pendants and small beads are known from numerous Glazkovo graves across Cis-Baikal. Lastly, at many cemeteries LN and EBA graves co-exist side by side, the older rarely disturbed by the younger, implying that the latter were somehow marked in ways that persisted over the intervening centuries.

3.6. Summary of typological dating

The overview presented above should help the reader navigate through the radiocarbon dates and the accompanying archaeological information compiled in Table 1 and Supplement 1. Regardless of the variation present in this material, including the exceptions, ambiguities and inconsistencies in the selection and description of mortuary traits, as long as they display at least some combination of the standard diagnostic characteristics, most graves are relatively easy to assign to a specific mortuary tradition. The problems, however, arise when they do not and in such instances additional criteria are taken into consideration, not always in a systematic manner. In some cases, research agenda, intuition or presence of other graves at a given cemetery, that are less ambiguous become decisive factors. Clearly, in such cases errors and disagreements are likely to appear. Overall, typology seems to work relatively well but mainly as a coarse dating tool. It is, perhaps, because of this relatively low resolution that, so far, there have been no

successful attempts to use typology toward developing a more detailed sequence for any of the periods, mortuary traditions, micro-regions or large cemeteries.

Based on the typological criteria summarized above all dated human burials have been assigned to a specific “Typological period” (Supplement 1). In the absence of published work, information provided by the excavators was used instead. In those instances where surface finds were dated, the column shows values expected based on the typological profile of the entire cemetery. For the typologically contentious graves from the Khotoruk and Kurma XI cemeteries “LM or EN” has been entered. Only in one instance was the published typological classification overwritten based in part on the re-evaluation of the archaeological context and in part on the radiocarbon date (Supplement 1). Grave 22 from Sarminskii Mys in the Little Sea, with no grave goods in it, was originally classified as LN Serovo due to the N orientation of the burial consistent with the other Serovo graves from this and other LN cemeteries in the vicinity, most with some grave goods (Goriunova, 1997). However, this orientation and the lack of grave goods are equally consistent with those displayed by similar graves from the Khotoruk and Kurma XI cemeteries, none of which appear to be LN. The corrected radiocarbon date for Sarminskii Mys Grave 22 falls within the LM.

4. METHODS

4.1. Correction of the freshwater reservoir effect

As mentioned above, a substantial freshwater reservoir offset in radiocarbon age between terrestrial herbivores and aquatic fauna of Lake Baikal from the same archaeological layers has been recently identified by Nomokonova *et al.* (2013). In order to correct for this offset, 42 pairs of dates on human bone and terrestrial herbivore bone or tooth samples, each from the same grave, were analyzed. This dataset represents five major middle Holocene cemeteries in the Cis-Baikal region: Lokomotiv (EN) and Ust'-Ida I (LN and EBA) in the Angara valley, Shamanka II (EN) on Southwest Baikal and Khuzhir-Nuge XIV and Kurma XI (both EBA) in the Little Sea (Fig. 1). Paired dates for a series of smaller cemeteries were also obtained from the Upper Lena micro-region: Popovskii Lug 2, Turuka, Zakuta, Ust'-Iamnaia and Makrushino (Fig. 1).

The regression equations use the human ^{14}C date and the $\delta^{15}\text{N}$ value for each tested individual and, in the case of the Little Sea and Upper Lena micro-regions, also the $\delta^{13}\text{C}$ measurement. Two different approaches were used to correct the human ^{14}C dates. While details of these two techniques are given in dedicated publications, it is important to emphasize that both, i.e., the Bayesian approach (Bronk Ramsey *et al.*, 2014) and the linear regression method (Schulting *et al.*, 2014; 2015) generated very similar corrections. Bronk Ramsey *et al.* developed a regional correction model and Schulting *et al.* worked out regional and micro-regional models. In the present study we use the two regression models developed by Schulting *et al.*:

<i>Regression model</i>	<i>Equation¹</i>	<i>S</i>	<i>r²</i>	<i>p</i>	<i>n</i>
Southwest Baikal & Angara	$Y = -1388.8522 + 125.4503 \times \delta^{15}\text{N}$	64.1	0.814	<0.000	15
Little Sea	$Y = -3329.5361 - 125.5967 \times \delta^{13}\text{C} + 95.1091 \times \delta^{15}\text{N}$	51.8	0.859	<0.000	16
Upper Lena (all)	$Y = -7364.1880 - 402.3963 \times \delta^{13}\text{C}$	183.6	0.490	0.016	11
Upper Lena (EBA)	$Y = -4289.8916 - 211.1860 \times \delta^{13}\text{C} + 45.3842 \times \delta^{15}\text{N}$	40.3	0.840	0.030	6

Where, Y is the predicted offset between the conventional (measured) and terrestrial (atmospheric) ^{14}C age for an individual and $\delta^{15}\text{N}$ is the nitrogen stable isotope value for the dated individual. The corrected ^{14}C age of an individual is then obtained by subtracting the offset value (Y) from the conventional radiocarbon age while the standard deviation of the corrected date is calculated according to the following equation:

$$\sqrt{(\text{s.d.})^2 + S^2}, \text{ where}$$

s.d. is the error associated with the conventional ^{14}C measurement and S is the standard deviation of residuals from the linear regression.

The first equation appears to work quite well for the Southwest Baikal and Angara micro-regions combined. Although the equation using $\delta^{15}\text{N}$ alone leaves some 20% of the observed variation in ^{14}C offsets unaccounted for (including the $\delta^{13}\text{C}$ value does not improve the predictive value of the model for these micro-regions), it does account for ~80% of that variation ($r^2 = 0.814$) which is a substantial improvement over no correction at all (Schulting *et al.*, 2014). The regression model developed for the Little Sea, which employs both stable isotope signatures ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) performs even better, accounting for ~86% of the variation in ^{14}C offsets in this micro-region ($r^2 = 0.859$) Still, it must be kept in mind that for some of the dates in the dataset the regression model does not work as well as it does for the majority and it is difficult at this time to identify such dates.

Two additional regression equations were calculated for the Upper Lena micro-region (Schulting *et al.*, 2015). The first is applicable to all chronological periods but its predictive value ($r^2 = 0.490$) is somewhat low and its associated error ($S = 183.6$) is rather high. Interestingly, in this case the correction is based on the $\delta^{13}\text{C}$ signature rather than on $\delta^{15}\text{N}$. Limiting the Upper Lena dataset to two EBA cemeteries (Ust'-Iamnaia and Makrushino) in the southern part of the micro-region substantially improves the predictive power of the correction equation ($r^2 = 0.840$, $S = 40.3$) bringing it to the same level as obtained for the other two micro-regions. In this instance, the main correction comes from the $\delta^{13}\text{C}$ values with $\delta^{15}\text{N}$ being of significant but secondary value. Since the predictive strength of the general Upper Lena correction is much lower relative to the other three equations, all LM, EN and LN dates from this micro-region are excluded from analysis, pending further work.

Because the Angara and Little Sea regression equations rely to a large extent on the $\delta^{15}\text{N}$ value, they cannot be applied to those individuals whose $\delta^{15}\text{N}$ is affected, in addition to the aquatic diet, by other factors such as nursing. This applies to the EBA sample for the Upper Lena

¹ Although regression equations are normally presented with one or two decimal places, here we show four as provided by the regression analysis and as employed in the calculation of the corrected dates. The rounding of the obtained products was done only at the very completion of the entire procedure rather than at each step.

although to a lesser extent because the correction there is based mainly on the $\delta^{13}\text{C}$ value. While it would be possible to subtract from the given isotopic measurement the assumed trophic level effect of 3–5‰, it is not clear whether the entire value should be applied. It would be unrealistic to expect lack of variation in the onset and nature of weaning (Weber *et al.*, 2002; Waters-Rist *et al.*, 2011) and subtract a fixed number depending on the age of an infant, for example 3‰ from $\delta^{15}\text{N}$ value of a 1-year-old, 2‰ from a 2-year-old, etc. Besides, skeletal age determinations of young children and the 3–5‰ trophic level fractionation both carry their own uncertainties (e.g., Reynard and Tuross, 2015). Based on our current knowledge about the onset of weaning among Cis-Baikal's middle Holocene foragers, and taking a conservative stance, radiocarbon dates of children assessed to be 5 years old or younger are not corrected.

Thus, results for 32 children from the Angara, Southwest Baikal and Little Sea micro-regions and for 2 additional infants from the Upper Lena have been omitted from this preliminary examination, though the matter will be revisited in the future. It must be kept in mind, however, that in individual cases some residual nursing effect might still be present in children older than 5 years. In these cases, the elevated $\delta^{15}\text{N}$ value may over-correct the radiocarbon determination thus resulting in a corrected date that is too young. Since in the present dataset there are only five children aged between 5 and 7 years old and two more aged broadly from 0 to 7 years, but probably closer to the upper boundary, this is unlikely to bias the overall analysis.

It can be argued that the animal dates from the paired dating program could be preferentially used over the corrected human bone dates, thus avoiding altogether the FRE for these burials. However, for consistency with graves that do not contain animal remains, we apply the regression equations for the FRE to all dated humans over the age of 5 years, including those in the paired dating program from which the corrections were developed.

4.2. Conventions

The radiocarbon determinations reported in this paper undergo a sequence of corrections and analyses and the following terms and acronyms are used to ensure clarity:

- (1) The ^{14}C determinations provided by ORAU are referred to as conventional, uncorrected, or simply ^{14}C or radiocarbon dates and they are presented in years BP.
- (2) ^{14}C dates transformed with the linear regression equations are referred to as corrected ^{14}C dates and they are also presented in years BP.

Only the corrected ^{14}C dates are calibrated and analyzed further using Bayesian statistics, generating two calibrated age estimates:

- (3) Each corrected ^{14}C date has a counterpart in the mean (μ) with standard deviation (σ) and median cal BP age of the highest posterior distribution (HPD) interval (Table 1); it is the means that are principally used for further quantitative analysis.
- (4) Groups of dates (events) are used to calculate durations of relevant archaeological intervals such as periods (phases) and their boundaries; these are presented in the text and graphs generated by OxCal as HPD intervals in cal BP years, Table 3 and graphs

providing the 68.2% and 95.4% confidence levels and probability distributions; following accepted practice, all modelled dates are presented in italics.

4.3. Combining radiocarbon dates

The entire set of ORAU radiocarbon determinations from the Baikal region used in this study, each with complete chemical data and relevant archaeological information, is presented in Supplement 1. The total number of dates was actually much higher than the 256 individuals included in the Bayesian analysis because in a number of cases the same burial was dated multiple times (Supplement 1). In most instances, this is a product of ORAU's routine internal checks involving repeat measurements. In other cases, the same sample or a different one from the same individual was submitted for analysis for additional checks, in some cases prompted by apparently errant results obtained on the first measurement. Such multiple dates representing the same individual were combined in the following manner:

1. *Method 1*: Dates on the same sample and on the same collagen extraction (indicated by the same "P" number) were first combined using an error-weighted mean as implemented in the R_Combine function of OxCal and next the resulting product was FRE-corrected. Dates on the same sample but on different extractions (indicated by different "P" numbers) were processed in the same fashion.
2. *Method 2*: Dates on two different samples (i.e., skeletal elements) were first FRE-corrected to account for the potentially slightly different turnover rates in the examined elements and next the resulting products were combined using the R_Combine function in OxCal.
3. *Method 3*: Sets of dates (usually three or more), which included repeats on the same and different sample, were transformed using a combination of these two methods.
4. The use of Methods 2 and 3 meant that in 14 instances we did not generate a combined radiocarbon determination before FRE correction and the associated field was left blank (Table 1). In these cases only the FRE-corrected dates were combined before calibration.
5. The chemical data, including the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, were averaged over such multiple runs to supply the data for the FRE correction (Table 1).

To combine the multiple dates available for some individuals, we chose to combine before rather than after calibration (i.e., using the R_Combine method of OxCal rather than the Combine method). The Combine method in OxCal allows combination of dates derived from different methods or from radiocarbon dates with different known age offsets; it assumes that each date and calibration provides completely independent information. In general, R_Combine method gives wider errors because it accommodates the fact that the uncertainty associated with the calibration of the different combined dates is highly correlated; it is intended for dates where the true age of the samples dated is the same within the resolution of the calibration curve (here effectively decadal). Although in this case there may be slight offsets on the dates on the same individual due to bone collagen turnover differences, these differences are likely to be small and in any case are not quantified. For this reason we conclude that combination before calibration (using R_Combine) is more appropriate and also more conservative, generating wider calendar range estimates.

4.4. Quantitative methods

Selection and implementation of quantitative analytical methods is driven by research goals and the kind of data analyzed. As mentioned, the main goals of this study are two: (1) reassess the middle Holocene culture history at the scale of entire Cis-Baikal based on the evidence of FRE-corrected and calibrated radiocarbon dates; and (2) search for specific micro-regional dietary trends and patterns using the same radiocarbon evidence and the associated carbon and nitrogen stable isotope ratios.

The first goal (regional culture history) is approached mainly with Bayesian modelling done in OxCal 4.2.4 using the IntCal-13 dataset (Reimer *et al.*, 2013; Bronk Ramsey, 2009; 2014). We are aware that this material lends itself to a variety of approaches to Bayesian analysis both in terms of units of analysis and functions used. In addition to the entire Cis-Baikal region, the micro-regions, mortuary traditions, separate cemeteries—large and small—or the distinct spatial formations within them such as clusters or rows of graves are all viable units of analysis. There are also graves with multiple individuals arranged horizontally on the same level (side-by-side) or vertically on different layers in some cases separated by a layer of sediment, as well as some graves that disturb one another. Lastly, changes in the temporal distribution of mortuary traits within various spatial units could also be examined. While some of this work is already in progress (Weber *et al.*, n.d.) it is clear that delving into even a few of these options in sufficient detail would be well beyond the scope of this preliminary study.

Bayesian modeling is guided by the following assumptions about the nature of the mortuary record in question:

- 1) Based on the archaeological data, i.e., typology and the previous radiocarbon record, regardless of the FRE, the general chronological sequence of the dated mortuary traditions should be as follows (from oldest to youngest): LM (including the undifferentiated LM and LM or EN) > EN (Kitoi) > MN (lack of formal cemeteries) > LN (Isakovo, Serovo) > EBA (Glazkovo).

Further, there are no empirical or theoretical grounds to assess:

- 2) Whether the period transitions (i.e., LM > EN Kitoi or LN Isakovo, Serovo > EBA Glazkovo) were overlapping, abutting or non-abutting.
- 3) The tempo (e.g., abrupt vs. gradual) of any of these transitions including the end of EN Kitoi, which is not followed by any archaeologically recognizable mortuary tradition.
- 4) Population models for the relevant groups (e.g., constant population or population growth—peak—decline, etc.) and resulting deposition rates regionally, micro-regionally or within each larger cemetery separately.
- 5) The extent to which period boundaries or cultural transitions (e.g., LN > EBA) were more or less contemporaneous across micro-regions.

Considering the above, two models were employed. The first builds on OxCal's default assumption of a uniform distribution of dated events (human burials in this case) within archaeological periods (phases) and thus invokes potentially relatively abrupt transitions. The uniform distribution model employs the following commands:

- *Sequence* to order events within a phase (group of events);

- *Boundary* to model start and end of various groups (phases) of events;
- *Span* to define temporal span of the dated events; and
- *Interval* to define phase durations.

However, in the context of the prior knowledge listed above, a model that allows some overlap between phases and gradual changes in deposition rates of the dated events may be a more realistic approach. In OxCal 4.2.4 it is the trapezium distribution that accommodates these conditions (Lee and Bronk Ramsey, 2012), congruent with the fact that the archaeological processes examined here are all population level changes and, as such, should be gradual, although the tempo may vary, and cumulative rather than abrupt and transformative. The trapezium model, in addition to the functions listed above, requires that the Boundary command be used in conjunction with the following three functions:

- *Transition* to allow a Boundary to have a none-instantaneous transition period as this function creates trapezium shaped distributions; and
- *Start* and *End* to find the start and end of a Boundary with a gradual transition period, respectively.

Both models, populated with the data from Table 1, were submitted to OxCal for analysis. The input files themselves are included as Supplements 2 and 3. The subsequent discussion is based primarily on the results from the trapezium distribution model but the outcome of the uniform model is invoked to note significant differences between them. Table 1 and Fig. 3A–B display results of the trapezium model only while Table 3 summarizes both.

In the uniform model the Spans are, as expected, always shorter than the Intervals, while this is not the case in the trapezium model where the Spans are sometimes longer than the Intervals (Table 3). This is because in the uniform model the Interval measures the length of the phase and is thus always longer than the Span. On the other hand, in the trapezium model the Interval command measures the distance between the mid-points of the phase transitions and so will in some cases be slightly shorter than the Span of dated events which will include those in the overlap-period between phases in the tails of the single trapezium distribution.

Our second goal involves the search for more specific temporal patterns. The data were divided into a number of archaeologically meaningful units of analysis based on “Micro-region” and “Typological period” (Table 2). The resulting numbers of dates representing such units, however, are quite variable, as some units have no dates at all and others have only very few dates. Therefore, while examination of culture history within Cis-Baikal as a whole employs the entire set of 256 dates, examination of micro-regional trends is applied to the following four units which are large enough to search for meaningful insights: EN Angara (n = 50), EN Southwest Baikal (n = 83), EBA Little Sea (n = 49) and EBA Upper Lena (n = 27).

This aspect of our analysis employs Bayesian modelling when applicable, but mainly Pearson product-moment correlation coefficients (PCC) between the conventional ^{14}C dates, means and medians of HPD intervals and $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ —the critical dietary variables in this examination. The means and medians of HPD regions were provided by the results from both trapezium and uniform distributions. Since in all cases the results were essentially the same, only

correlations with the means of HPD regions from the trapezium distribution model are reported in the paper. Scatter plots and descriptive statistics are also used, the former mostly for illustrative purposes and identification of non-linear relationships between relevant variables.

4.5. Data assessment

Of the 36 individuals with multiple ^{14}C determinations, 33 passed the χ^2 test (Ward and Wilson 1978), while two cases failed by only a small margin and were retained in the Bayesian analysis; the final case failed by a large margin and was removed from the analysis (Table 1). However, stable isotope results for this last individual (LOR_1997.011²) are presented in scatter plots (Fig. 2A).

Since the PCC analysis is quite sensitive to outliers, all datasets suitable for examination of chronological trends were screened using the outlier labeling technique (Hoaglin *et al.*, 1986; Hoaglin and Iglewicz, 1987). Only one individual, SHA_2004.042.02 from the Shamanka II cemetery, failed this test due to its low $\delta^{15}\text{N}$ value of 10.4‰ (Table 1, Fig. 2A). While this value is not unusual for the entire Cis-Baikal, it is clearly the lowest measurement from the EN Shamanka II and Angara datasets. It is unlikely that this is a matter of measurement error because two different samples were analyzed at ORAU, both giving essentially the same result, and yet another sample measured previously at the University of Calgary produced a value of 11.1‰, the lowest in the Calgary dataset and also an outlier (Weber *et al.*, 2011: Table 9). The low $\delta^{15}\text{N}$ signature suggests a diet with much less contribution from aquatic food and, together with the $\delta^{13}\text{C}$ measurement of -17.7‰ , implies an origin different than either Southwest Baikal or the Angara River. If so, the regression formula developed for the Angara and Southwest Baikal micro-regions may not be applicable. Consequently, the radiocarbon date and stable isotope results for this individual are excluded from Bayesian modelling and PCC tests, respectively, but the isotopic values are presented in the graphs (Fig. 2A). Weber *et al.*, (n.d.) provide additional justification for the temporary exclusion of this case from chronological analysis. One other individual from Shamanka II (SHA_2003.026.02), with the second lowest low $\delta^{15}\text{N}$ value of 12.0‰ in this sample (Supplement 1, Fig. 2A), passed the test marginally and is therefore retained in the analysis.

SHA_2008.106 is also excluded from analysis, although still displayed in stable isotope scatter plots (Fig. 2B), but merely because it belongs to the Late Bronze Age (LBA), a culture historical period represented only by this single case. This burial produced a very late uncorrected radiocarbon date congruous with the typological dating of the grave good assemblage that included three tri-lobe bronze arrowheads with long, tapered stems.

Data for 16 LM, EN and LN individuals from the Upper Lena micro-region are also excluded from the chronological analysis, although their stable isotope signatures are presented in graphs for comparative purposes (Fig. 2). Finally, results for 34 young children from the entire Cis-

² Each individual analyzed by the Baikal–Hokkaido Archaeology Project is assigned a master identification number, which includes the following information: abbreviated site name (e.g., LOK for Lokomotiv), excavation year (e.g., 1997) and grave number (e.g., 011). In graves with more than one interment, the grave number is followed by an extension indicating its number as in SHA_2004.042.02 (i.e., Shamanka 2004 excavation, grave 42, individual 2).

Baikal whose $\delta^{15}\text{N}$ signatures are potentially subject to the nursing effect are removed from analysis altogether and thus are not included in Supplement 1.

While radiocarbon dating of skeletal remains of middle Holocene hunter–gatherers from Cis-Baikal continues, the current spatio-temporal distribution of 256 ^{14}C -dated LM, EN, LN and EBA interments from all four micro-region is seen as sufficiently representative for the goals of this exploratory study (Table 2). Examination of more specific trends will commence once more data are available regionally or for specific cemeteries.

5. DISCUSSION: REGIONAL CHRONOLOGY

The benefit of starting the discussion with an assessment of regional chronology is that it lessens, to a certain extent, the biases resulting from the uneven representation of the various spatio-temporal units in our current dataset (Table 2). Also, examination of regional chronology permits a focus on the general picture without the need to discuss the micro-regional peculiarities for which the evidence is not yet adequate. These biases and idiosyncrasies will become more evident within each separate micro-region and will thus be discussed later. Another advantage is that on the regional scale the main culture historical units—excepting the MN of course—are represented in the dataset, albeit with variable numbers, and this permits assessment of required revisions to their temporal boundaries, the main goal of this study. Lastly, while it is not necessarily expected that the boundaries of the relevant culture historical periods are the same from one micro-region to another, the frequently small sample sizes prevent examination of each micro-region in detail.

5.1. Late Mesolithic: from 8277 ± 176 to 7503 ± 14 mean HPD cal BP

Despite the introduction of radiocarbon dating into Cis-Baikal archaeology, the chronological position of this group of graves remained ambiguous for a long time (Weber *et al.*, 2010), essentially until this study. Included in the current project is the original skull from Pad'-Khin'skaia, the eponymous site in the Angara valley (PKH_1936.001; Table 1, Supplement 1), recently rediscovered in the Kraevedcheskii Muzei in Irkutsk.

Our results confirm the presence of graves pre-dating the EN Kitoi in Cis-Baikal. The LM group (n=10) includes the two burials originally classified as “LM” and an additional eight interments classified as “LM or EN” (Tables 1–2). The corrected dates for the eight “LM or EN” graves place them either well before the EN Kitoi on the Angara and Southwest Baikal or within its beginning. Interestingly, the grave from Ershi, classified by Bazaliiskii (2010) as Final Mesolithic, is the youngest of all graves in this group and its corrected ^{14}C determination post-dates the oldest EN Kitoi burials by ~50 years. In the trapezium model, the LM starts and ends much later though with roughly similar duration (774 ± 176 years) as in a previous assessment of 8800–8000 cal BP (Weber *et al.*, 2010: Table 2.3). In the uniform distribution model, the LM is ~140 years longer mostly due to its earlier beginning (Table 3).

These early graves appear across the entire region but are quite rare, and the sites are rather different from one another and from any of the later well-known mortuary traditions. LM

cemeteries are invariably small, the largest being Khotoruk and Kurma XI on Lake Baikal with seven and six graves, respectively. However, while originating within the LM, both cemeteries appear to have been used sporadically and continued into the EN. It is doubtful that many more graves and cemeteries dating to this period will be found in the region. Therefore, the LM lower boundary will likely continue to be defined only in approximate terms but the upper boundary seems to be established quite firmly, at least on the regional scale, due to the abundant radiocarbon record from the EN Kitoi mortuary tradition that provides a constraint for Bayesian modelling.

5.2. Early Neolithic: from 7503±14 to 7027±33 mean HPD cal BP

The EN is the best represented of all archaeological periods in our current dataset (n=133). The dates come from a dozen or so cemeteries, small and large, from two micro-regions (Table 1 and 2, Supplement 1). Admittedly, the dataset is dominated by two cemeteries—Lokomotiv, in the Angara valley, and Shamanka II, Southwest Baikal—but this situation is unlikely to change as the dominant Kitoi mortuary tradition of this period is mainly known from there. Of the other large EN cemeteries, Vitkovskii's (1982, 1989) materials from the eponymous Kitoi cemetery are not available for analysis, and while dating of Ust'-Belaia (Georgievskaja, 1989) will somewhat rectify this imbalance, dating of the rest of Lokomotiv burials will skew the imbalance back in favour of the large cemeteries. In the Little Sea and on the Upper Lena EN graves—whether of the Kitoi tradition or otherwise—are rare and this is unlikely to change. Still, the 133 dates for 418 EN burials (32%) currently known from the entire region provide a very good sample (Weber and Bettinger, 2010: Table 3).

Due to the large number of dates and to their consistency the temporal parameters of the EN (i.e., upper and lower boundaries and duration) are rather sharply defined (Table 3, Fig. 3) both at the 68.2% and 95.4% probability levels. According to the results of the trapezium distribution model, these parameters differ considerably from the previous model (Weber *et al.*, 2010: Table 2.3). Instead of the estimated 1000–1200 years long, the EN now appears to be only 476±37 years in duration (or 711±36 years long in the uniform distribution model), mostly as a result of its much later start (~500 years). This asymmetric shift is attributable to a combination of two factors: (1) different typo-chronological grouping of the graves and (2) the impact of Bayesian modelling. Regarding the first, in the previous assessments, some of the dates (e.g., from Khotoruk and Kurma), assigned here to the LM, were grouped with the EN thus shifting the start of this period back in time. Regarding the second factor, Bayesian analysis was not employed at the time of the previous chronological study.

Continued dating of EN mortuary assemblages is unlikely to change substantially the chronological parameters of this period, which, at this point, depend more on how this dataset is analyzed. However, additional dating, and further refinement of spatial and temporal variation in the FRE, will be critical for better assessment of the larger cemeteries' internal chronology and use patterns as well as for understanding the temporal relationships between individual cemeteries within and across micro-regions.

5.3. Middle Neolithic: from 7027±33 to 5571±88 mean HPD cal BP

Because of the complete lack of dated mortuary assemblages, the MN is defined by the upper and lower boundaries of the temporarily adjacent groups of dated EN and LN graves, respectively (Weber *et al.*, 2010). To make this matter clear, it is not necessarily the case that people largely abandoned Cis-Baikal at the end of EN, only that the EN socio-economic model(s), Kitoi or otherwise, was rearranged into a system that did not include formal cemeteries, and did not see continued use of those established in the EN.

In comparison to the previous model, according to which the MN was 1000–1200 years long (Weber *et al.*, 2010: Table 2.3), the trapezium and uniform distribution models suggest 1456±94 and 1300±66 year durations, respectively (Table 3). The longer duration of the MN is primarily accounted for by the shortened EN interval and by the much later start of the LN. However, it must be kept in mind that the LN is represented in the current study by fewer dates than in the previous analysis. To be sure, there is much that we do not yet know about the cause and mechanism of this transition or about the socio-economic system that developed across the entire Cis-Baikal during the MN. These questions still require much thought and fieldwork to search for isolated MN burials and assemblages at campsites.

5.4. Late Neolithic: from 5571±88 to 4597±76 mean HPD cal BP

Relative to what has been excavated and published so far, the LN mortuary traditions are not very well represented in our dataset (Weber and Bettinger, 2010: Table 3). Of the 227 LN burials reported, we have radiocarbon dates for only 22 (10%) and this situation is unlikely to improve any time soon for two reasons. First, the current location of most of the materials from Okladnikov's early field campaigns and from those conducted on the Angara later in the 1950s and 1960s, when the dams in Irkutsk and Bratsk were being constructed, is difficult to establish (Okladnikov, 1974, 1975, 1976). The one skull from the Isakovo cemetery, found recently in the Kraevedcheskii Muzei, and dated for this study (ISA_1932.002) is only a minor consolation with little impact. Second, LN cemeteries elsewhere in Cis-Baikal appear to be rare and rather small with the largest being Verkholsk on the Upper Lena (20 graves; Okladnikov, 1978) and Sarminskii Mys in the Little Sea (13 graves; Goriunova 1997; 2002). Continued dating of Isakovo graves from the Ust'-Ida I cemetery will provide more data but will not address the imbalance in geographic distribution in the Angara valley, where the Isakovo and Serovo traditions have been documented at 27 locations along the 700 km long stretch of the river between Baikal and Bratsk. An additional disadvantage of the current LN dataset is the complete absence of dates for Serovo graves from the Angara micro-region.

Due to the relatively small sample size the temporal parameters of the LN are not as sharply defined as for the EN (Table 3, Fig. 3). Bayesian modeling of the FRE-corrected dates affects the LN chronological parameters differently relative to the EN. The length of the LN appears roughly the same—973±126 years now (Table 3, Fig. 3) vs. 800–1000 years previously (Weber *et al.*, 2010: Table 2.3)—but the period starts and ends a few hundred years later, as a direct

result of the FRE correction. The main difference with the parameters from the uniform distribution model is in the earlier end of the LN by ~300 years which also makes its duration correspondingly shorter. Additional dating of LN graves may push the lower boundary further back in time and extend its duration. It may also affect the upper boundary, and thus the temporal overlap with the following EBA.

5.5. Early Bronze Age: from 4597 ± 76 to 3726 ± 34 mean HPD cal BP

On the regional scale, the EBA is represented by 91 dated burials of the 520 currently known (18%), presenting a reasonably sized sample. Their geographic distribution, however, is rather uneven. The Little Sea and Upper Lena South are well represented but the Angara is not (Table 2). Of the 204 EBA burials recorded in the Angara valley, few are available for analysis for the same reasons as outlined above for the LN. Lastly, although we only have six dates from Southwest Baikal, there are only additional five individuals to be dated, all from Shamanka II, the single EBA cemetery to have been documented in this micro-region (and possibly reflecting one or two violent episodes rather than a normal cemetery; see Bazaliiskii *et al.*, 2001; Lieverse *et al.*, 2012).

Even though the number of EBA dates is over four times that of the LN, the differences between the relevant chronological parameters at the 68% and 95% probability levels are higher than for the LN (Table 3). According to the trapezium model, the EBA starts ~400–600 years later, ends ~200 years earlier and is only about 871 ± 91 years long, thus 600–800 years shorter, when compared with the previous chronology (Weber *et al.* 2010: Table 2.3). In the uniform distribution model the EBA starts about 300 years earlier than in the trapezium model, thus affecting its longer overall duration (1204 ± 41 years). Modelling of the transition between LN and EBA periods suggests continuity and overlap between them. The current dataset does not allow assessment of the relationship between the EBA and the following LBA period, which is represented in this study by only one burial from Shamanka II (SHA_2008.106) with a corrected date roughly 800 years younger than the latest date in the EBA sequence. While it makes sense to expect continuity between these two periods, assessment of this transition with radiocarbon dates will be difficult because LBA graves, for unknown reasons, are as rare as those from the LM. Future dating may bring about adjustments to the upper boundary of the EBA.

6. DISCUSSION: MICRO-REGIONAL PATTERNS

In order to avoid unnecessary repetition this section focuses on detection of dietary patterns and trends that are specific to each micro-region and which might be less clearly visible on the regional scale. Consequently, the analysis is limited to those datasets that are large enough to provide meaningful insights. Transitions between periods is another topic potentially suitable for examination at the micro-regional level; however, the frequently insufficient samples sizes force us to leave this matter aside until more data are available.

6.1. Early Neolithic Angara

The Angara valley is the micro-region with the longest history of research on Holocene hunter-gatherers in Cis-Baikal and is also the area that provided the bulk of the archaeological materials analyzed by Okladnikov in his synthesis (1950, 1955, 1974, 1975, 1976). Unfortunately, for the reasons mentioned earlier, of 536 interments documented to date most are no longer available for research and only 76 have been included in this analysis (Weber and Bettinger, 2010: Table 3). Of these, only the EN sample with 50 dated burials (i.e., 26% of the 194 known) from seven cemeteries is sufficiently representative for further examination.

The corrected ^{14}C dates range from 6559 ± 81 BP (LOR_1991.007.01) to 5939 ± 74 BP (ROZ_2008.003, Table 1). On average, the entire sequence of corrected dates is 465 ^{14}C years younger than the uncorrected series with the lowest and highest corrections for the FRE being 350 ^{14}C years for LOK_1990.043.02 (6555 ± 73 BP) and 651 ^{14}C years for ROZ_2008.003 (5939 ± 74 BP), respectively (Table 1).

In search for chronological trends scatterplots of mean HPD cal BP dates and associated carbon and nitrogen stable isotope values were explored and correlations (PCC) between these three variables were calculated. While the mean HPD cal BP dates and $\delta^{13}\text{C}$ values show no temporal pattern (PCC, $r = 0.103$, $p = 0.478$, $n = 50$), $\delta^{15}\text{N}$ values display a strong negative relationship with the mean HPD dates: the isotope values get higher as the dates become younger (Fig. 4; PCC, $r = -0.711$, $p < 0.000$, $n = 50$). This suggests a temporal shift in diet toward greater reliance on aquatic foods toward the end of the EN relative to its beginning. This is an entirely new and very important finding. It is unlikely that this trend is an artefact of the transformation of the uncorrected dates based on the regression analysis even though it makes the individuals with high $\delta^{15}\text{N}$ values archaeologically younger. The reason for this is that the trend is not invariably seen in other micro-regions where $\delta^{15}\text{N}$ values are equally or even more variable (e.g., Little Sea). Also, the chronological position of each individual in the sequence still depends to a great extent on the conventional ^{14}C date. Interestingly, the three Angara LM individuals appear to extend the beginning of this trend back in time by about 1000 years. Prior to their FRE-correction, the Angara EN radiocarbon dates still show a statistically significant, albeit moderate, negative correlation with $\delta^{15}\text{N}$ values (PCC, $r = -0.402$, $p = 0.004$, $n = 49$).

The relatively tight clustering of both carbon and nitrogen values ($\sim 2\%$ on either scale; Fig. 2A) suggests correspondingly homogenous values in the aquatic food sources contributing to the diet of the EN groups in the Angara valley. This practically eliminates Lake Baikal as the potential source of these foods because of the substantial isotopic variability seen there. More specifically, Baikal's various fishes and the lake's endemic seal (*Phoca sibirica*) cover together a wide range in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from about -25% to -10% and 10% to 16% , respectively (Weber *et al.*, 2011: Table 4 and 5). Any significant dietary contribution of the seal would be relatively easy to detect because of its low $\delta^{13}\text{C}$ values (about -22%). Adding this food item to the diet mix would result in more ^{13}C -depleted human values and individual variation would result in a more scattered distribution of the Angara EN sample. This is what we see in the EN sample from the Southwest Baikal and in the EBA sample from the Little Sea (Fig. 2A and 2B) but not in the EN Angara sample. Thus, the clustered distribution of EN human stable isotope

values from the Angara valley is more consistent with procurement of the local sources where the fishes are expected to show a much narrower range of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values and the Baikal seal is absent. In sum then, the EN diachronic trend in human $\delta^{15}\text{N}$ results on the Angara is best accounted for by an increased reliance on riverine resources.

6.2. Early Neolithic Southwest Baikal

Despite the fact that archaeological finds dating to the middle Holocene have been reported from the area extending westward from the southwest tip of Lake Baikal toward Lake Hovsogol in Mongolia, Shamanka II is the only currently known mortuary site in this micro-region. With no LN graves and only six EBA and one LBA dated burials from Shamanka II, our sample is heavily biased toward the EN. The corpus of EN geochemical data from Shamanka II is a subject of a separate study on which the following summary is based (Weber *et al.*, n.d.). Excluding SHA_2004.042.02, the remaining 83 corrected EN ^{14}C dates from Shamanka II range from 6653 ± 70 BP (SHA_2006.066.01) to 5835 ± 75 BP (SHA_2005.059.01; Table 1). The corrected sequence is on average 456 ^{14}C years younger than the uncorrected series and the lowest and highest corrections recorded are 117 ^{14}C years for SHA_2003.026.02 (6373 ± 73 BP) and 693 ^{14}C years for SHA_2006.083.02 (6402 ± 74 BP), respectively (Table 1).

Chronologically, the Shamanka II sequence generally parallels the sequence of mean HPD cal BP dates currently available for the Angara valley although the Shamanka II series appears to start roughly 40 years earlier and to end 70 years later than the Angara sequence. Note, however, that there are still many more EN graves from the Angara valley to be dated than there are from Shamanka II and this may affect these differences. A more important and better documented difference between the two micro-regions seems the temporal gap of about 200 years in the distribution of mean HPD dates at Shamanka II between 7123 ± 94 cal BP (SHA_2007.086.01) and 6918 ± 83 cal BP (SHA_2004.049.01) (Table 1). The relevant portion of the middle Holocene calibration curve features a few flat or even reversed sections, the product of variations in the $^{14}\text{C}/^{12}\text{C}$ ratio of the Earth's atmosphere. However, while the gap partly coincides with one such section on the calibration curve, visible roughly between 7150 and 7050 cal BP, Bayesian modelling confirms that the discontinuity in the dates is real rather than a product of the variation in atmospheric ^{14}C production over time.

This provides initial evidence for the presence of two EN phases of cemetery use at Shamanka II: Phase 1 (longer) and Phase 2 (shorter). Such discontinuity is neither visible in the Angara valley taken as a whole, nor in the dates from Lokomotiv only. Interestingly, Phase 2 at Shamanka II appears to continue after the termination of the Kitoi mortuary tradition on the Angara. Given that as many as ~45 individuals from Shamanka II—most of them adults—have not yet been dated these results could potentially fill the gap in the distribution of the calibrated dates. However, the presence of two phases is supported by additional evidence regarding the changes in how the cemetery was used during Phase 2 relative to Phase 1. This matter, discussed in more detail in a separate study (Weber *et al.*, n.d.), will be assessed further once the dating of Shamanka II is completed.

Returning to the issue of the dietary trend at Shamanka II, the set of 83 ^{14}C dates and associated stable isotope results shows no correlation with $\delta^{13}\text{C}$ and only a small negative association between the mean HPD cal BP dates and $\delta^{15}\text{N}$ values, neither statistically significant (PCC, $\delta^{13}\text{C}$, $r = 0.033$, $p = 0.764$, $n = 83$; $\delta^{15}\text{N}$, $r = -0.143$, $p = 0.196$, $n = 83$). However, calculating correlations by phase gives quite different results and reveals trends similar to that found on the Angara (Fig. 5):

- Phase 1: PCC, $\delta^{13}\text{C}$, $r = -0.021$, $p = 0.865$; $\delta^{15}\text{N}$, $r = -0.360$, $p = 0.002$; $n = 70$; and
- Phase 2: PCC, $\delta^{13}\text{C}$, $r = 0.355$, $p = 0.235$; $\delta^{15}\text{N}$, $r = -0.914$, $p = 0.000$; $n = 13$.

The resulting Phase 1 correlation is only moderate while Phase 2 association is strong and exceeds the value observed on the Angara. That the correlation within the entire dataset at Shamanka II is much weaker—and statistically insignificant—than within each phase separately is explained partly by the fact that at the beginning of Phase 2 the $\delta^{15}\text{N}$ values appear to return to a level comparable to the beginning of Phase 1, i.e., to relatively less reliance on aquatic foods and partly by the more diverse diets of Phase 1 individuals relative to Phase 2 (Fig. 5).

Another point to address is why the dietary trend toward increased reliance on aquatic foods during Phase 1 is less clearly expressed than for Phase 2. The reason for this appears to be, as examined in detail by Weber *et al.* (n.d.), that Phase 1 is composed of four dietary groups: one displaying no change in diet over time and three other showing dietary trends each emphasising different sources of freshwater food such as the shallow water fishes of the nearby Kultuk Bay, Lake Baikal seal, and the fishes of surrounding rivers. Since these food groups display quite different carbon and nitrogen stable isotope values, combining them into one analytical unit results in much weaker relationships between the relevant variables.

Unfortunately, at this point we do not have a readily available explanation for both the two-pulse pattern and the diversity of dietary trends during Phase 1 and their detailed exploration goes beyond the scope of this paper (cf. Weber *et al.*, n.d. for some suggestions in this regard). Overall, as argued above in the section on the Angara EN chronology, we feel confident that the trends are real rather than a product of the regression analysis. Still, these patterns at Shamanka II are being investigated further through additional paired dating, to refine the FRE regression equation for this site specifically.

Overall, the most interesting finding from the examination of radiocarbon measurements and the carbon and nitrogen stable isotope ratios for the Shamanka II cemetery is that there are chronological trends involving increased reliance on aquatic foods, mostly fish, and that these changes parallel a similar trend found among the neighbouring Angara EN groups.

For the record, correlations prior to date correction are just the inverse of the results after the FRE transformation and would suggest decreased over time reliance on aquatic foods:

- Phase 1: PCC, $\delta^{13}\text{C}$, $r = 0.232$, $p = 0.065$; $\delta^{15}\text{N}$, $r = 0.393$, $p = 0.001$; $n = 64$; and
- Phase 2: PCC, $\delta^{13}\text{C}$, $r = 0.377$, $p = 0.253$; $\delta^{15}\text{N}$, $r = 0.937$, $p = 0.000$; $n = 11$.

6.3. Early Bronze Age Little Sea

Of the roughly 277 middle Holocene burials known from the Little Sea micro-region (Weber and Bettinger, 2010: Table 1), 64 (23%) have been dated for this study. Although this dataset is clearly biased toward the EBA, the low numbers of LM, EN and LN dates seem to reflect the general rarity of those graves there (Table 2). Since the relative frequencies of culture historical designations of the burials that can still be dated are similar to the sample examined in this study, these proportions are not expected much to change. The currently available sample of dated humans comprises 49 of the 203 (24%) documented EBA individuals in this micro-region.

The Little Sea features a level of isotopic complexity that needs to be taken into consideration. Previous work identified two different diets—game-fish-seal (GFS) and game-fish (GF), and two different groups of people—locals and non-locals (Weber and Bettinger, 2010; Weber *et al.* 2011; Weber and Goriunova, 2013). The diet types were identified on the basis of carbon and nitrogen stable isotope data and the origin of the individuals was established on the basis of strontium isotope ratios measured in first molars (Haverkort *et al.*, 2008). It is believed that the locals were born within the geographic confines of the Little Sea and they are assumed to have spent most of their lives in this micro-region. The diet of these locals was found to be invariably GFS. The non-locals appear to have been born outside of the Little Sea, possibly on the Upper Lena, and moved to the northwest coast of Lake Baikal later in their lives. The diet of the non-locals was found to be either GF or GFS, in roughly equal proportions (Weber and Goriunova, 2013). In other words, many people in the Little Sea micro-region displaying the local GFS diet appear to be of non-local origin. These individuals earlier in their lives probably consumed a GF diet, perhaps on the southern reaches of the Upper Lena. This matter, however, requires further investigation in light of the results of the paired dating programme for that micro-region (Schulting *et al.*, 2015).

Although this dietary distinction was made on the basis of stable isotope data obtained from the University of Calgary in collaboration with Dr. M.A. Katzenberg, the current set of stable isotope results from ORAU shows the same pattern (Fig. 2B). Since, for the most part, different sets of burials were analyzed in the two laboratories this pattern seems quite robust. While in the Calgary dataset, individuals with GF diet were found in all three periods (EN, LN and EBA; Weber *et al.*, 2011: Table 7, Fig. 4C), the ORAU dataset currently shows individuals with GF diets only in the EN and EBA (Supplement 1, Fig. 2). Considering the Calgary and ORAU datasets together, the GFS diet dominates the EBA sample roughly by 3 to 1.

These two distinctions—GFS vs. GF diets and locals vs. non-locals—are important because they affect the definition of analytical units. For example, the relative continuity of LN and EBA may suggest that these two periods should be analyzed together. Doing so, however, would skew the correlation results because in the ORAU dataset the GF diet is currently absent in the LN sample while present in the EBA sample. This would very likely suggest a trend from greater to lesser reliance on aquatic foods across the combined LN–EBA period (Fig. 6). For this reason, the analysis is limited to the EBA sample, which is complicated enough due to the dietary and provenance differences mentioned above. Furthermore, it would be preferable to divide the GFS

group into two units: GFS–local and GFS–non-local. This, however, is not possible at the moment due to the lack of strontium data for most of the individuals displaying the GFS diet.

The corrected ^{14}C dates for the EBA group range from 4410 ± 43 BP (SHM_1975.001) to 3474 ± 60 BP (SHM_1973.003.01; Table 1). For the GFS dataset ($n = 39$), the minimum, maximum, and average FRE corrections are 262 (KHA_2010.015, 3849 ± 60 BP), 536 (SHM_1973.003.01, 3774 ± 60 BP), and 406 ^{14}C years, respectively, while for the individuals with the GF diet ($n = 10$) these figures are 14 (K14_2000.077, 3776 ± 56 BP), 362 (KUR_2002.019, 3759 ± 58 BP), and 200 ^{14}C years, respectively (Table 1). The relatively large FRE corrections for the GFS group are also important because in a few instances the conventional ^{14}C date would put the dated individual in the wrong culture historical period, i.e., the LN (Supplement 1). Correction for the FRE and Bayesian modelling, however, supports the original typological assignment as EBA.

The results of the correlation analysis between mean HPD cal BP dates and stable isotope values for the 49 EBA individuals from the Little Sea are as follows:

- GFS individuals: PCC, $\delta^{13}\text{C}$, $r = 0.329$, $p = 0.041$; $\delta^{15}\text{N}$, $r = 0.142$, $p = 0.389$; $n = 39$;
- GF individuals: PCC, $\delta^{13}\text{C}$, $r = -0.255$, $p = 0.477$; $\delta^{15}\text{N}$, $r = -0.216$, $p = 0.549$; $n = 10$;
- and
- GFS and GF individuals together: PCC, $\delta^{13}\text{C}$, $r = 0.344$, $p = 0.016$; $\delta^{15}\text{N}$, $r = 0.214$, $p = 0.140$; $n = 49$.

Most of these correlations are not statistically significant and the two that are show only moderate strength of association. Still, they merit a few comments due to some interesting regularities. First and regarding the GFS group, the moderate positive correlation between mean HPD cal BP dates and $\delta^{13}\text{C}$ values is statistically significant ($p = 0.041$) and could be accounted for by increased consumption of the Baikal seal, the food resource showing the most negative $\delta^{13}\text{C}$ values among the aquatic foods from the lake potentially consumed by these foragers (around -22‰ ; Weber *et al.*, 2011: Table 5). Should this be the case, however, one would also expect a negative correlation with $\delta^{15}\text{N}$ results, for the seal—the top predator in the lakes’ ecosystem—measures high on this scale (11.4–15.6‰; Weber *et al.*, 2011: Table 5). The matter, as mentioned above, is complicated by the fact that the GFS group is not homogenous in terms of origin: some people are locals and some are not. Since the fishes of the Upper Lena show even more depleted values (from -27‰ to -24‰) than the seals (Weber *et al.*, 2011: Table 5), it is possible that the our data reflect not a dietary trend but increased over time migration of people from the Upper Lena. It is also possible that both trends were taking place at the same time. This argument would still hold even if the place of origin of the non-locals were not the Upper Lena but some other watershed(s), roughly north of Baikal, because $\delta^{13}\text{C}$ values in the fishes there would still be expected to fall into the same very light range, generally characteristic of immature rivers. The matter is further complicated by the fact that the FRE on the Upper Lena appears to be considerably higher than that observed for the individuals with the GF diet in the Little Sea area, making it difficult to see how the former could be the origin of the latter (Schulting *et al.*, 2015).

Second, the GF group—likely non-local in origin—is the only one that shows negative albeit statistically not significant correlations: both stable isotope values become more positive (higher) as the associated dates become younger (lower). If analysis of additional individuals with GF diet shows this pattern to be significant, it would have to be explained in terms of an increased reliance on shallow water fishes as has been also suggested for the Angara and some of the Shamanka II EN groups.

And lastly, combining the GFS and GF groups into one unit produces another trend—a moderate positive correlation—that is also statistically significant: $\delta^{13}\text{C}$ values become lower as the mean HPD cal BP dates get younger ($p = 0.015$). Again, this could be explained by increased consumption of the Baikal seal; however, it is unclear whether this represents a dietary trend or a migration of people from some area, such as the Upper Lena, with low $\delta^{13}\text{C}$ values in its freshwater fishes.

Consequently, it is too early to address this matter conclusively but the results underscore three points: (1) the importance of the FRE correction; (2) the equal importance of determining the place of origin of as many Little Sea individuals as possible; and (3) that there is still much to be learned about the composition and source of the GF diet.

Below, we also report the associations between uncorrected ^{14}C dates and stable isotope values (Fig. 7):

- GFS individuals: PCC, $\delta^{13}\text{C}$, $r = -0.004$, $p = 0.981$; $\delta^{15}\text{N}$, $r = -0.184$, $p = 0.277$; $n = 37$;
- GF individuals: PCC, $\delta^{13}\text{C}$, $r = -0.632$, $p = 0.050$; $\delta^{15}\text{N}$, $r = 0.530$, $p = 0.115$; $n = 10$;
and
- GFS and GF individuals together: PCC, $\delta^{13}\text{C}$, $r = 0.270$, $p = 0.594$; $\delta^{15}\text{N}$, $r = 0.594$, $p < 0.000$; $n = 47$.

Of note is the strong negative association between ^{14}C and $\delta^{13}\text{C}$ values for the GF diet (all non-locals) and the strong positive association between ^{14}C and $\delta^{15}\text{N}$ values for the GFS and GF diet group combined. The first pattern would mean increased consumption of the Baikal seal or fishes with similarly or more negative $\delta^{13}\text{C}$ values and the second would likely mean decreased reliance on aquatic foods with time. While these two trends contradict one another, neither is apparent after FRE correction of the radiocarbon dates.

6.4. Early Bronze Age Upper Lena South

Relative to the Angara valley and the Little Sea micro-regions, the Upper Lena has seen much less archaeological fieldwork but much more, at least in terms of the number of excavated cemeteries ($n = 41$) than Southwest Baikal. Since all EN and LN individuals have been excluded from the chronological analysis for the reasons mentioned above, the discussion is limited to the group of 27 EBA individuals (47% of 58 documented archaeologically) from 8 cemeteries.

Unfortunately, the largest cemetery excavated in the area—Verkholsk with ~50 LN and EBA individuals (Okladnikov, 1978)—has yet to be analyzed but a pilot study is underway. Future archaeological work in the area has the potential to increase substantially the number of LN and EBA cemeteries and burials available for analysis.

At the moment, the corrected EBA ^{14}C dates range from 4138 ± 51 BP (OBK_1976.003) to 3475 ± 50 BP (BO2_1971.003, Table 1). On average, the entire sequence of corrected dates is 287 ^{14}C years younger than the uncorrected series with the lowest and highest FRE corrections being 39 ^{14}C years for OBK_1971.003.02 (3911 ± 50 BP) and 504 ^{14}C years for MAK_1992.018 (3986 ± 51 BP), respectively (Table 1).

Even though none of the stable isotope measurements display statistically significant associations with the mean HPD dates (PCC, $\delta^{13}\text{C}$, $r = -0.133$, $p = 0.509$; $\delta^{15}\text{N}$, $r = -0.003$, $p = 0.986$; $n = 27$), the matter still merits some discussion because the area featured prominently in the preceding discussion of dietary patterns during the EBA in the neighbouring Little Sea micro-region. Taking into consideration the food resources available on the Upper Lena, the lack of a dietary trend there toward increased reliance on aquatic foods is not particularly surprising. This is because the fishes in the Upper Lena, and in its many but small tributaries, are an order of magnitude less abundant than on the Angara (Kozhov, 1950; Weber and Bettinger, 2010: Table 2) and likely equally less abundant than in the shallows of Lake Baikal.

In other words, the Upper Lena lacks food resources as a viable alternative to the terrestrial game (red deer, moose and roe deer), in the other micro-regions supplied in considerable abundance by the aquatic environment. Thus, facing a shortage of terrestrial game, for whatever reasons—cultural or natural, rather than turning attention to the much poorer than elsewhere local fishery, a more effective strategy could have been migration to other places, such as the Little Sea, where at least the aquatic foods offered better returns than on the Upper Lena. This would account for the fact that in our stable isotope data for the EBA, including the results produced by Dr. M.A. Katzenberg, University of Calgary (Weber *et al.*, 2011: Table 8), we do not see much evidence for permanent relocation of people from the fish-rich micro-regions, i.e. the Angara and the Little Sea, to the fish-poor Upper Lena. None of the Upper Lena EBA individuals examined shows stable isotope signatures characteristic of the Angara EBA and only two display $\delta^{15}\text{N}$ values that are in the range of the GFS diet group. That is, in the ORAU dataset (Table 1), one result (14.7‰) comes from an adult female (MAK_1992.018) and the other from a child, probably of an immediately post-weaning age whose $\delta^{15}\text{N}$ measurement of 15.0‰ could still be affected by nursing (MNZ_1974.004.01). However, it is surprising that on the Angara we currently do not seem to see any EBA individuals of possible Upper Lena origin, though the sample size is small (Table 2). The two Angara individuals displaying $\delta^{13}\text{C}$ values in the range characteristic of the Upper Lena are of the LN age (Fig. 2B, Table 1).

Overall then, the Upper Lena EBA groups do not appear to have lived there entirely without experiencing dietary trend but the trend seems to be of a slightly different kind. The emphasis on freshwater foods appears to have been practiced not at home but in a fish-rich micro-region (i.e. Little Sea) and not by all individuals but only by those who decided to relocate there, that is the Little Sea's GF diet group. Combining the Upper Lena EBA set with the Little Sea EBA GF set, while justified, does not, however, reveal statistically significant associations between the relevant variables. More results, not only in terms of the number of examined individuals but

also in terms of additional geochemical tracers, will be needed from both micro-regions to resolve these complicated interactions.

7. CONCLUSION

This is another paper in the series of studies examining the FRE in the Cis-Baikal region and its impact on the chronology of the middle Holocene archaeology there. The first three demonstrated the influence of the FRE on ^{14}C -dated human remains in the Cis-Baikal ecosystem and developed equations to correct for it (Bronk Ramsey *et al.*, 2014; Schulting *et al.*, 2014; 2015), while in this study we make use of these new developments (see also Weber *et al.*, n.d.). More specifically, applied to several sets of radiocarbon and carbon and nitrogen stable isotope results from the middle Holocene in Cis-Baikal, the approach allows new findings with regard to culture change over time. First, it identifies a dietary trend toward a greater reliance on aquatic foods during the EN on the Angara and on Southwest Baikal. Prior to the correction of the radiocarbon dates for the FRE these trends are either not as strong or run in the opposite direction that is toward decreased reliance on aquatic foods. Second, it identifies the potential presence of two phases of cemetery use at Shamanka II with people in each displaying roughly similar dietary shifts. And third, it helps correct the trend observed among the EBA groups in the Little Sea micro-region. Rather than an increased over time dietary contribution of the Baikal seal, increased migration of people from a different area, perhaps the Upper Lena, appears to be a more likely explanation. Additional tests on Cis-Baikal human skeletal materials are expected to shed more light on these processes.

While all findings from this analysis are important, the significance of the identification of the EN chronological trends in diet is paramount. As mentioned early in the paper, much bioarchaeological work has been completed on middle Holocene human skeletal remains from Cis-Baikal with a number of interesting and important findings; none, however, have defined any kind of temporal changes within archaeological periods (e.g., EN, LN or EBA), micro-regions (e.g., Angara, Southwest Baikal, Little Sea, and Upper Lena) or specific cemeteries (e.g., Shamanka II, Lokomotiv, Ust'-Ida I, or Khuzhir-Nuge XIV). Simply put, all our findings thus far have revealed patterns resulting from comparison between these large units of analysis rather than their constituent components, i.e., human individuals. Consequently, the discovery of the dietary trend during the EN is an extremely promising result, as it marks the beginning of a major shift in current research on middle Holocene foragers in the Baikal region from the focus on comparison between these large and ahistorical units of analysis to examination of temporal changes within them down to the level of individual cemeteries. Despite the extensive program of radiocarbon dating applied to the middle Holocene foragers in the Baikal region, the chronological dynamic within each of the relevant spatio-temporal units was hitherto missing. It is not only the stable isotope measurements that can be analyzed taking into account the chronological dimension but also the bioarchaeological and mortuary datasets. Such large bodies of information as those provided by the Shamanka II, Lokomotiv, Ust'-Ida I and Khuzhir-Nuge

XIV cemeteries, which have been documented and studied more comprehensively than the others, are likely to produce many revealing insights.

Another question that comes immediately to mind is to what extent the increased contribution of the aquatic food during the EN on the Angara and Southwest Baikal is related to the local depletion of high-ranked terrestrial game resources (moose, red deer and roe deer) either due to natural causes or to overhunting. In theory, any large concentration of people in one place for any length of time—quite convincingly supported in both micro-regions by the presence of large cemeteries—should relatively quickly lead to cycles of game depletion and recovery (e.g., Belovsky, 1988). Although this matter will be difficult to resolve empirically due to the notoriously low temporal resolution of archaeological layers at the region's campsites, the new tool for FRE correction of dates on human remains may offer assistance in this regard. This is because it is also expected that cycles in game resources should be followed by corresponding changes in distribution of the hunter-gatherer population (Belovsky, 1988). It is reasonable to expect that such demographic fluctuations could also be reflected in shifts in use patterns of the existing cemeteries as well as establishment of new ones and this can now be traced effectively with the FRE regression models. More work on the matter is clearly in order including the paleoecological modelling of the terrestrial and aquatic food resources in the region during the middle Holocene.

The revised ages of the various mortuary traditions may bring them more in line with the dating of assemblages from stratified sites, a discrepancy noted recently for the Little Sea micro-region (Goriunova and Novikov, 2010). In this regard, however, it is important to note that perfect correlation between the age of relevant mortuary traditions and associated cemeteries on one side and corresponding strata at habitation sites on the other is not expected. This problem is related to the fact that both kinds of sites are a product of entirely different site formation processes; whereas cemeteries form rather well delineated spatially and temporally units of analysis this is not the case with habitation sites. Ideally, one would want the materials representing LM, EN, LN, and EBA mortuary traditions each to correspond to a separate stratum, which, unfortunately, is rather unrealistic. At campsites natural formation processes can be highly variable from one location to another, and materials can be mixed into strata with any combination of these units. Furthermore, including in the mix the MN component, which is not represented in mortuary sites, will add even more complexity to an already complex situation. In a nutshell, correlation between mortuary and habitation sites, both in terms of chronological and material culture, is a rather difficult matter and one should not expect major breakthroughs any time soon.

Also, even though the entire middle Holocene culture historical sequence is now only a few hundred years younger than previously thought, the FRE correction will help in examination of relationships between the Cis-Baikal archaeological sequence with other chronological models that are unaffected by the FRE. This regards both the archaeological sequences beyond Cis-Baikal as well as paleoenvironmental reconstructions based either on proxy records or mathematical models.

Overall, successful FRE correction opens several new and important avenues for future research. Dating of the remaining human skeletal materials from the entire Cis-Baikal region, including the rest of the burials from Lokomotiv and Ust'-Ida I, will be essential in the effort. It is regrettable that many important materials from the earlier excavations appear to be unavailable for research. However, a few other collections are accessible but, for other reasons, have not been examined so far by the Baikal–Hokkaido Archaeology Project. These include the cemeteries of Shumilikha (EBA) on the Angara (Svinin, 1981), Verkholsk (LN and EBA) on the Upper Lena (Okladnikov, 1978), Uliarba (EBA) and Ulan-Khada (mostly EBA) in the Little Sea area (Komarova and Sher, 1991; Goriunova, 2004), and Fofanovo (EN and EBA) in the Selenga delta (Gerasimov and Chernykh, 1975). Work on these materials will drive future refinements to the culture history of middle Holocene hunter–gatherers in the Cis-Baikal region.

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Figures

Figure 1. Location of the archaeological sites examined in the paper.

No.	Site	No.	Site	No.	Site
3	Ershi	82	Ulus Khal'skii	122	Sarminskii Mys
7	Glazkovo	84	Makrushino	124	Kulgana
8	Lokomotiv	85	Iushino	129	Shamanskii Mys
14	Kitoi	89	Popovskii Lug 2	138	Kurma XI
16	Galashikha	91	Makarovo	141	Khuzhir-Nuge XIV
18	Shumilikha	95	Nikol'skii Grot	149	Borki
19	Ust'-Belaia	98	Obkhoi	142	Shamanka II
36	Ust'-Ida I	99	Ust'-Iamnaia	148	Khadarta IV
40	Gorodishche II	101	Zapleskino	152	Kaiskaya Gora
44	Pad' Khinskaia	108	Turuka	154	Roshcha Zvezdochka
72	Isakovo	109	Zakuta	156	Badai
81	Manzurka	114	Khotoruk		

Figure 2. Geographic distribution of carbon and nitrogen stable isotope values for Middle Holocene individuals from Cis-Baikal examined in the paper: (A) Late Mesolithic and Early Neolithic; (B) Late Neolithic, Early Bronze Age and Late Bronze Age.

Figure 3. Results of Bayesian modeling of temporal parameters for the middle Holocene culture history in Cis-Baikal using the trapezium distribution: (A) period boundaries; (B) period intervals and spans.

Figure 4. Mean HPD cal BP dates by $\delta^{15}\text{N}$ for the Late Mesolithic and Early Neolithic in the Angara valley.

Figure 5. Mean HPD cal BP dates by $\delta^{15}\text{N}$ for the Early Neolithic on Southwest Baikal.

Figure 6. Mean HPD cal BP dates by $\delta^{13}\text{C}$ (A) and $\delta^{15}\text{N}$ (B) for the Late Neolithic and Early Bronze Age in the Little Sea.

Figure 7. Conventional radiocarbon dates BP by $\delta^{13}\text{C}$ (A) and $\delta^{15}\text{N}$ (B) for the Late Neolithic and Early Bronze Age in the Little Sea.

Tables and Supplements

Table 1. Corrected radiocarbon dates for the middle Holocene Cis-Baikal region and results of the Bayesian analysis using the trapezium distribution model. Cases are grouped by “Typological period” and sorted by “Corrected date BP”.

Table 2. Geographic and temporal distribution of FRE-corrected radiocarbon dates used in the Bayesian analysis of middle Holocene Cis-Baikal culture history.

Table 3. Summary of Bayesian modeling of corrected ORAU radiocarbon dates for the middle Holocene Cis-Baikal region.

Supplement 1. Archaeological and ORAU geochemical data for the middle Holocene Cis-Baikal region employed in the study. Cases are grouped by micro-region and then sorted by “Site” and “Master_ID”.

Supplement 2. OxCal 4.2.4 input file for Bayesian analysis of middle Holocene culture history of Cis-Baikal, Siberia, using the default uniform distribution model. All dates are corrected for the freshwater reservoir effect and grouped by culture historical periods and then sorted by corrected ^{14}C date BP.

Supplement 3. OxCal 4.2.4 input file for Bayesian analysis of middle Holocene culture history of Cis-Baikal, Siberia, using the trapezium distribution model. All dates are corrected for the freshwater reservoir effect and grouped by culture historical periods and then sorted by corrected ^{14}C date BP.

Figure 1
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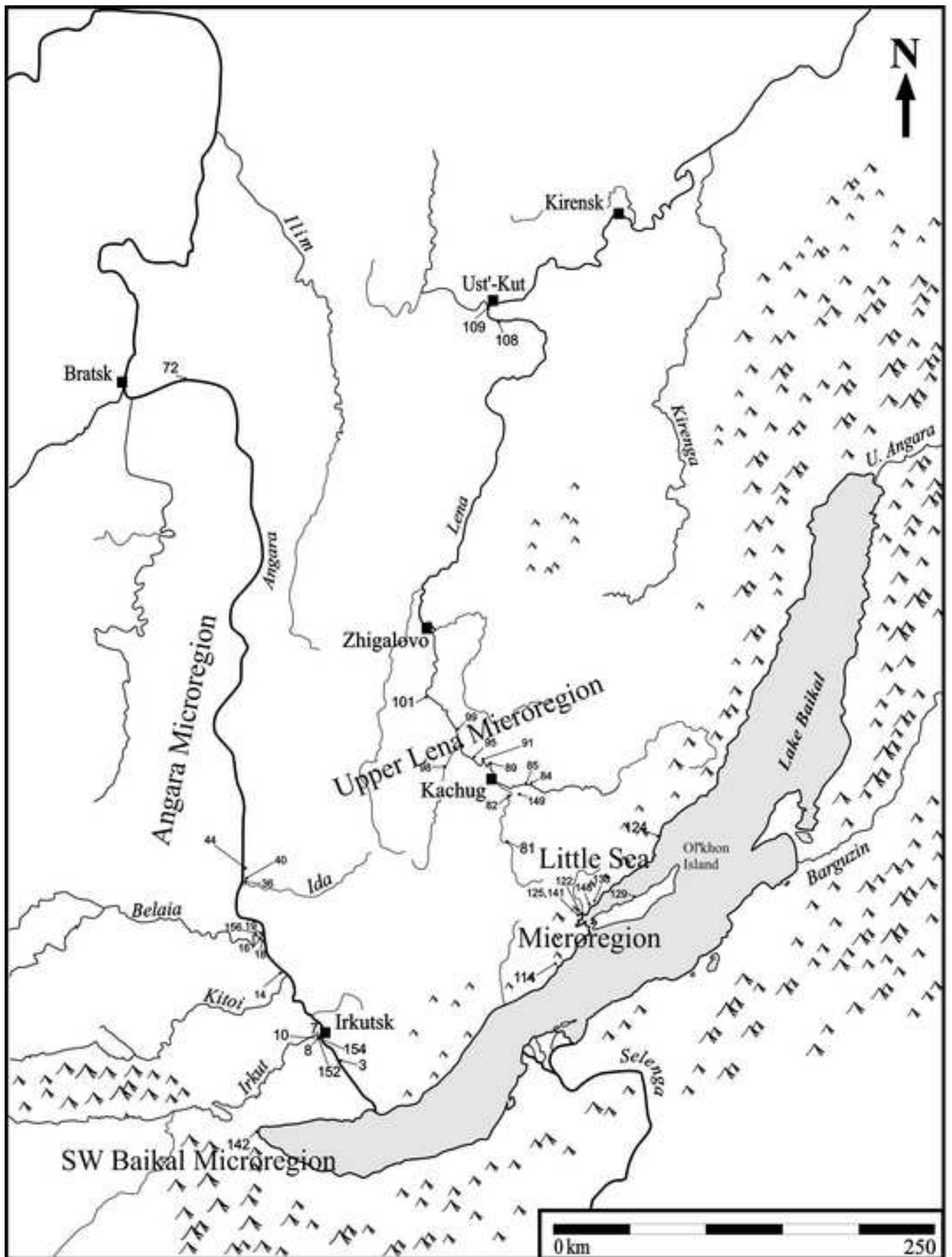


Figure 2A
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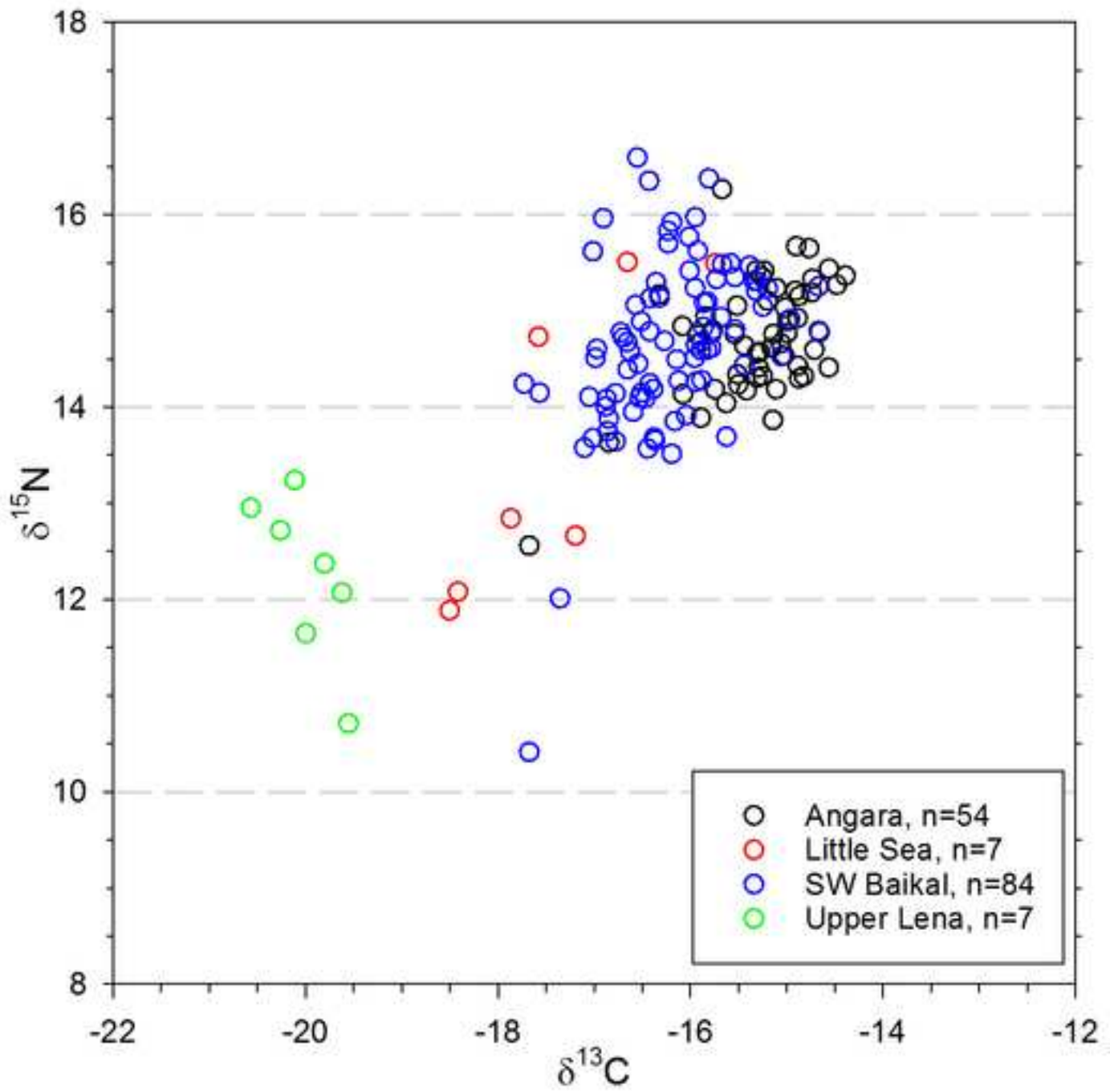


Figure 2B
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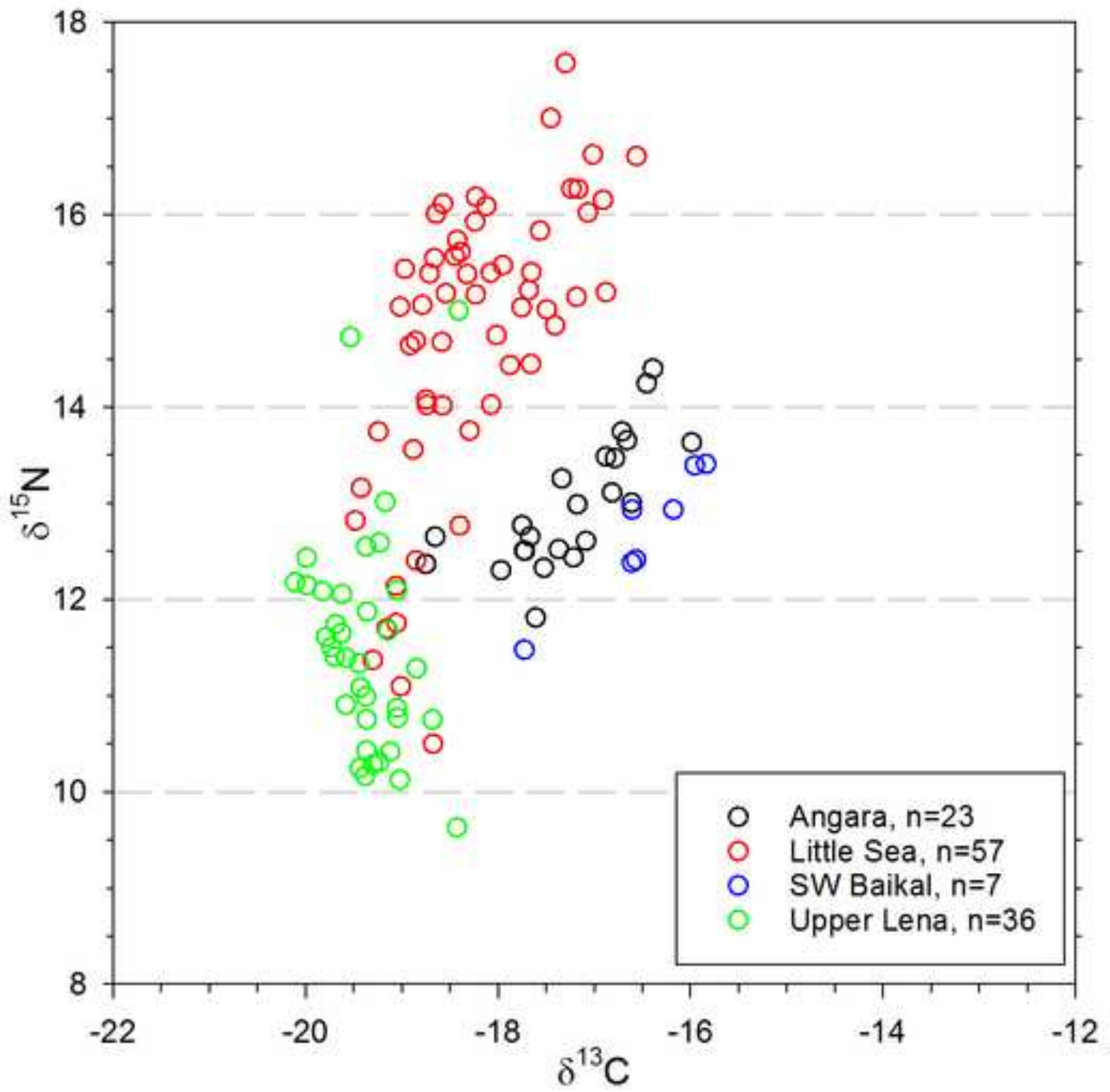


Figure 3A

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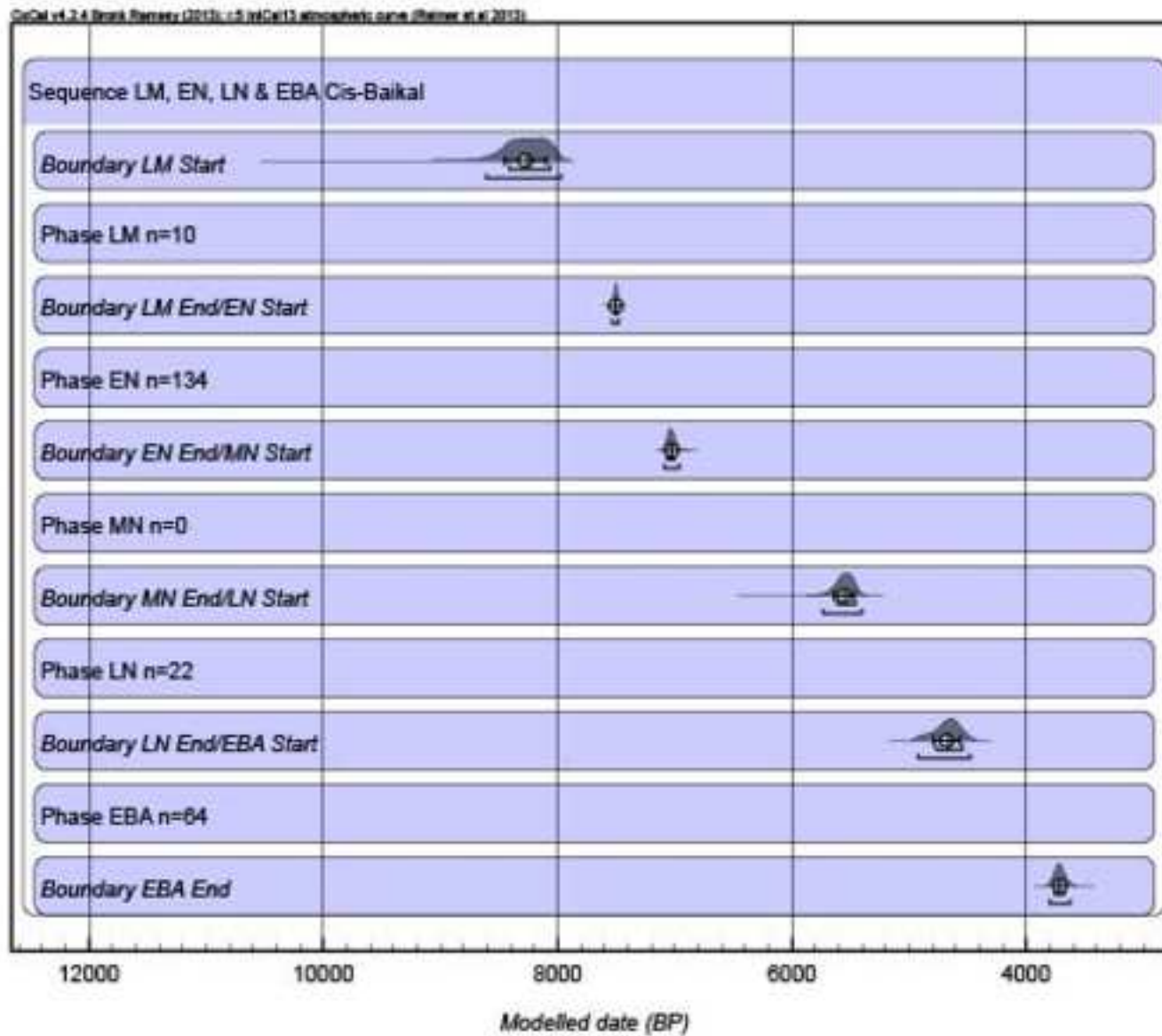


Figure 3B
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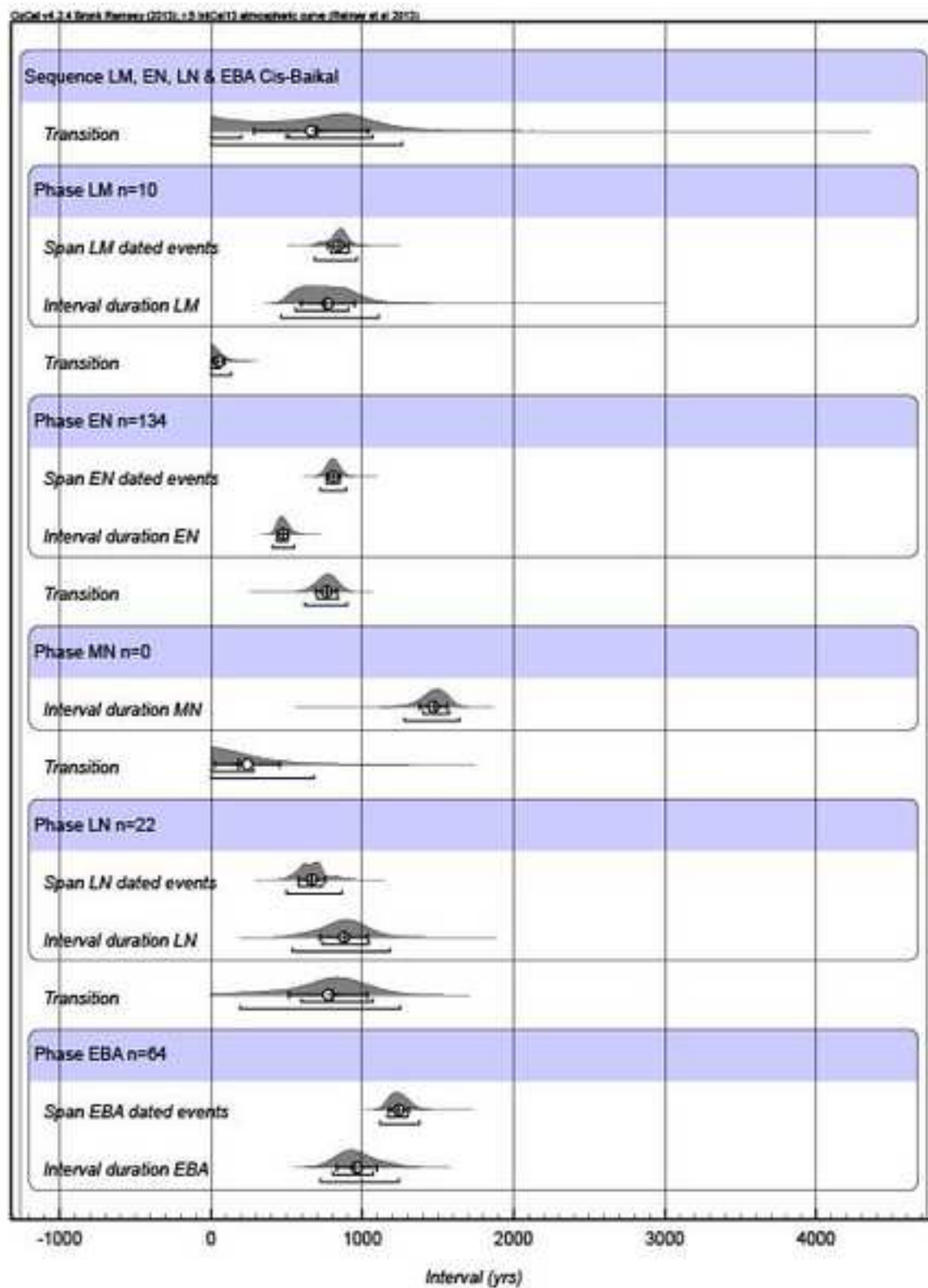


Figure 4

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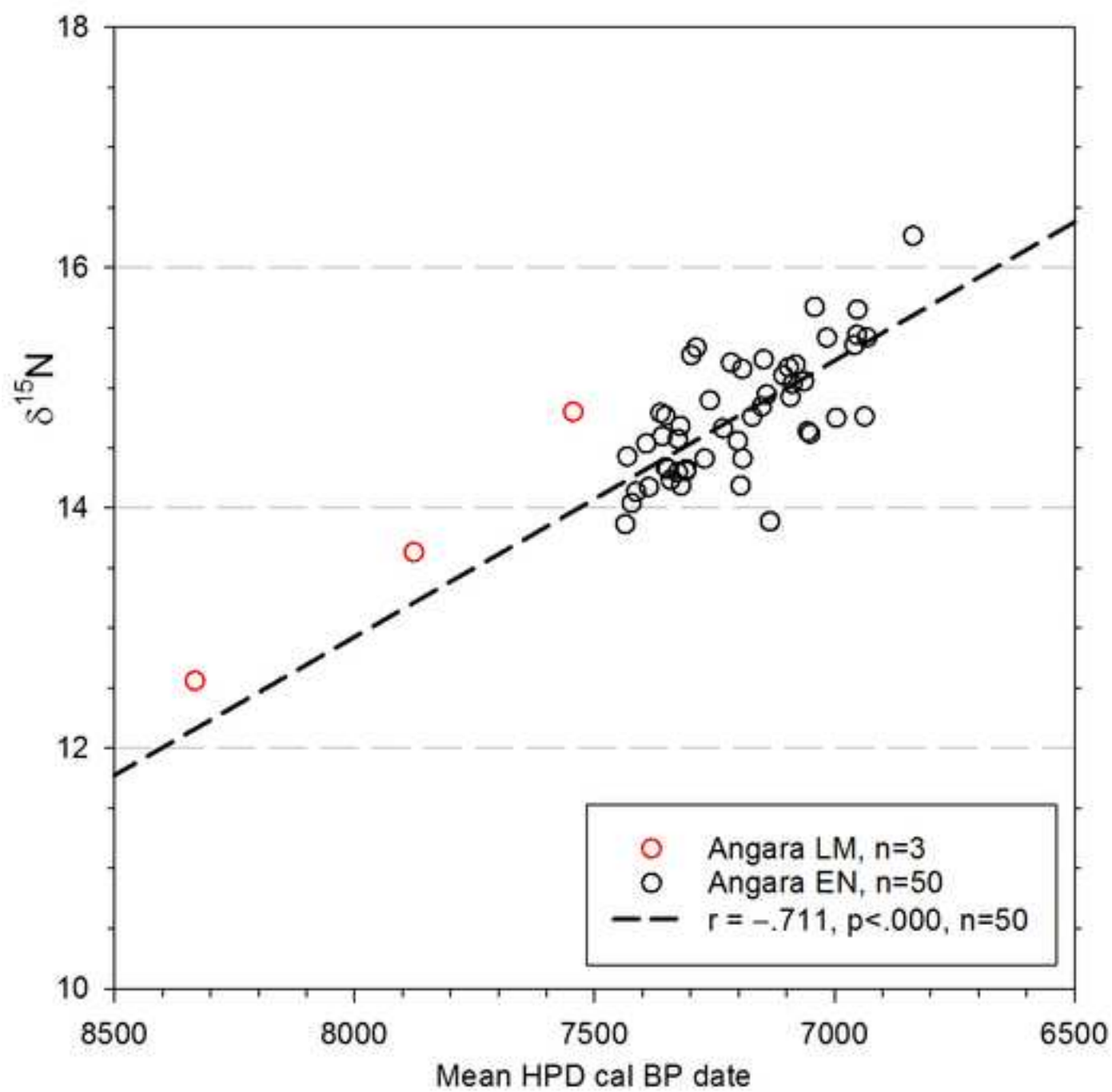


Figure 5
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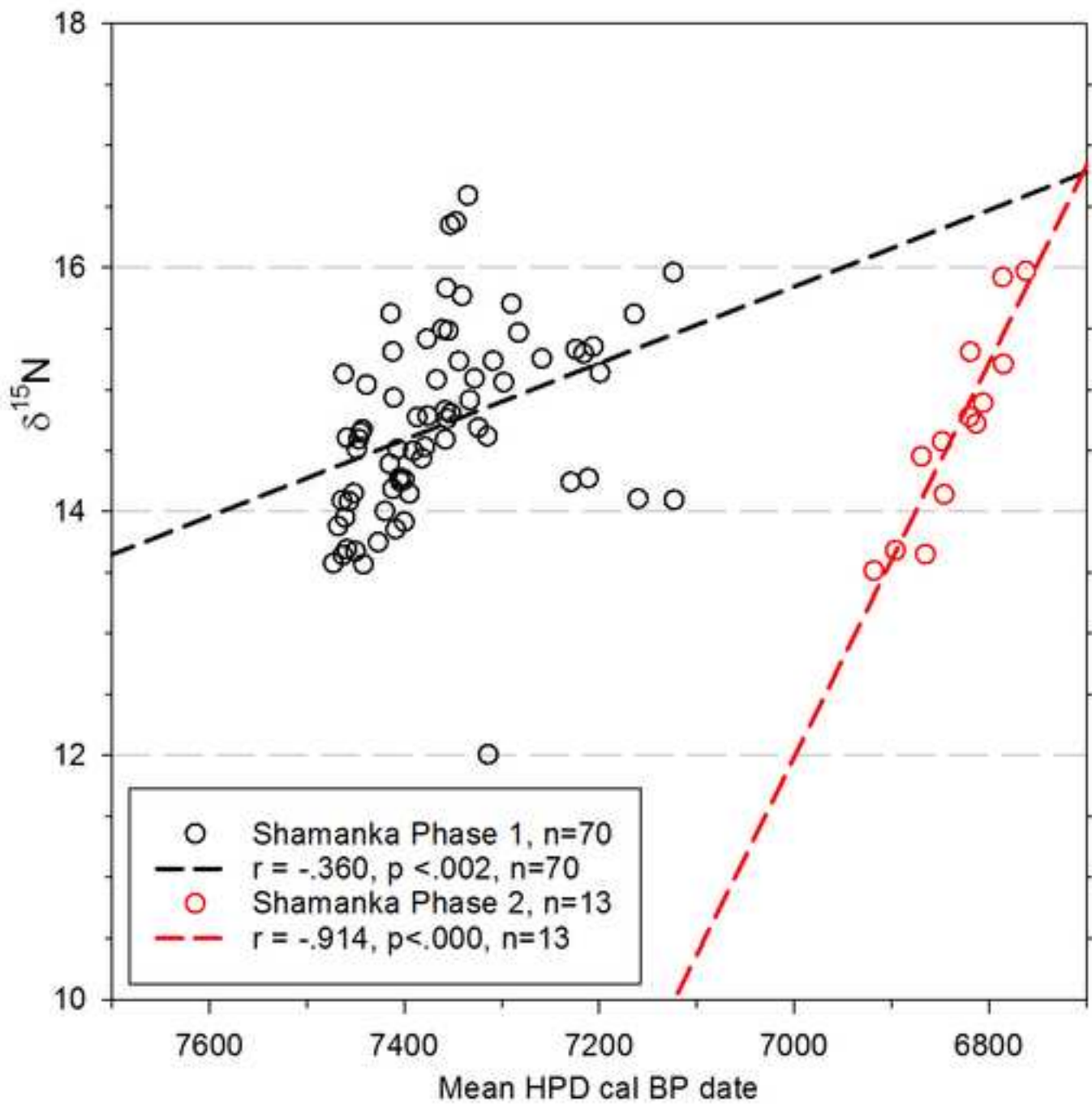


Figure 6A

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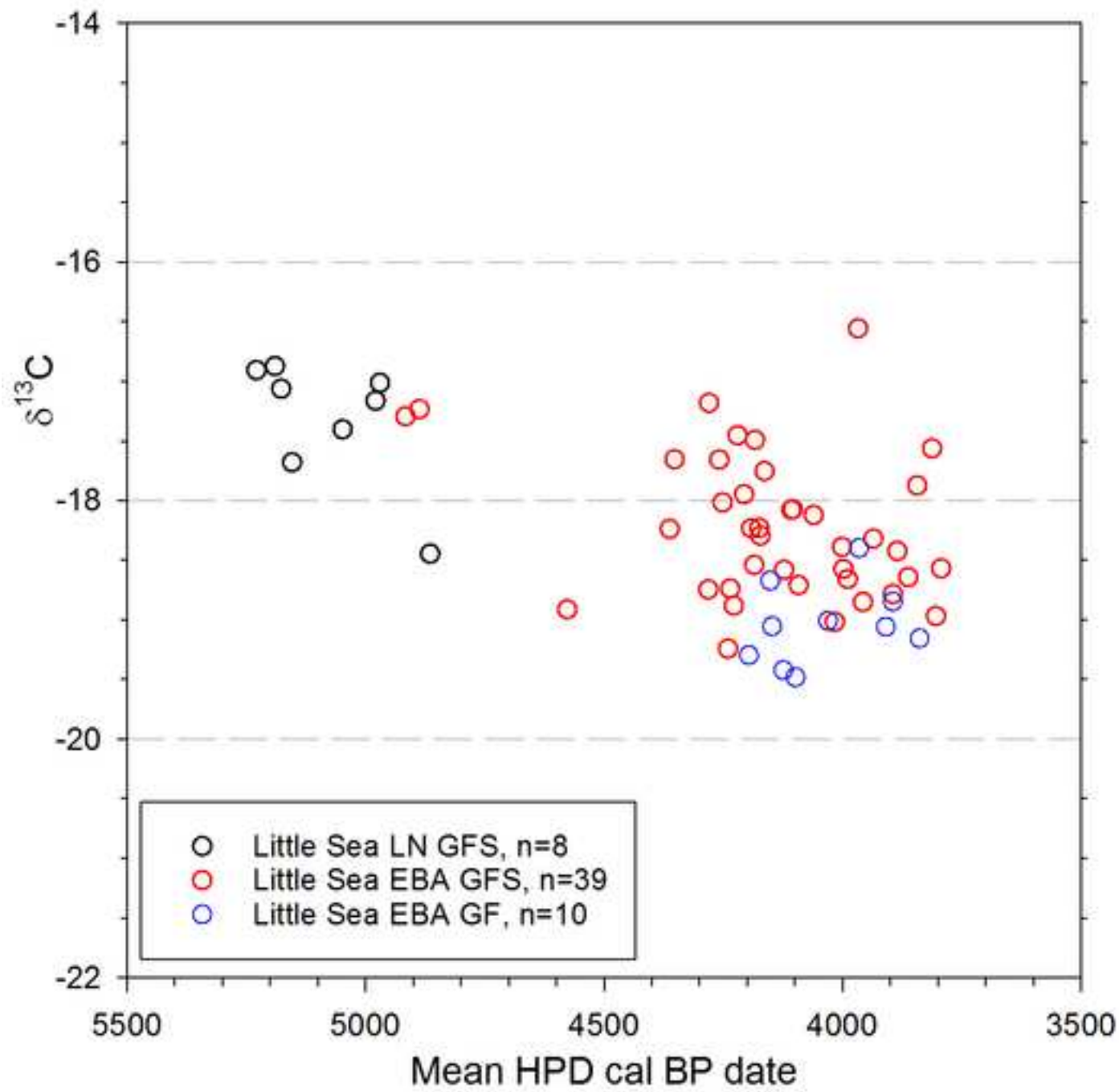


Figure 6B
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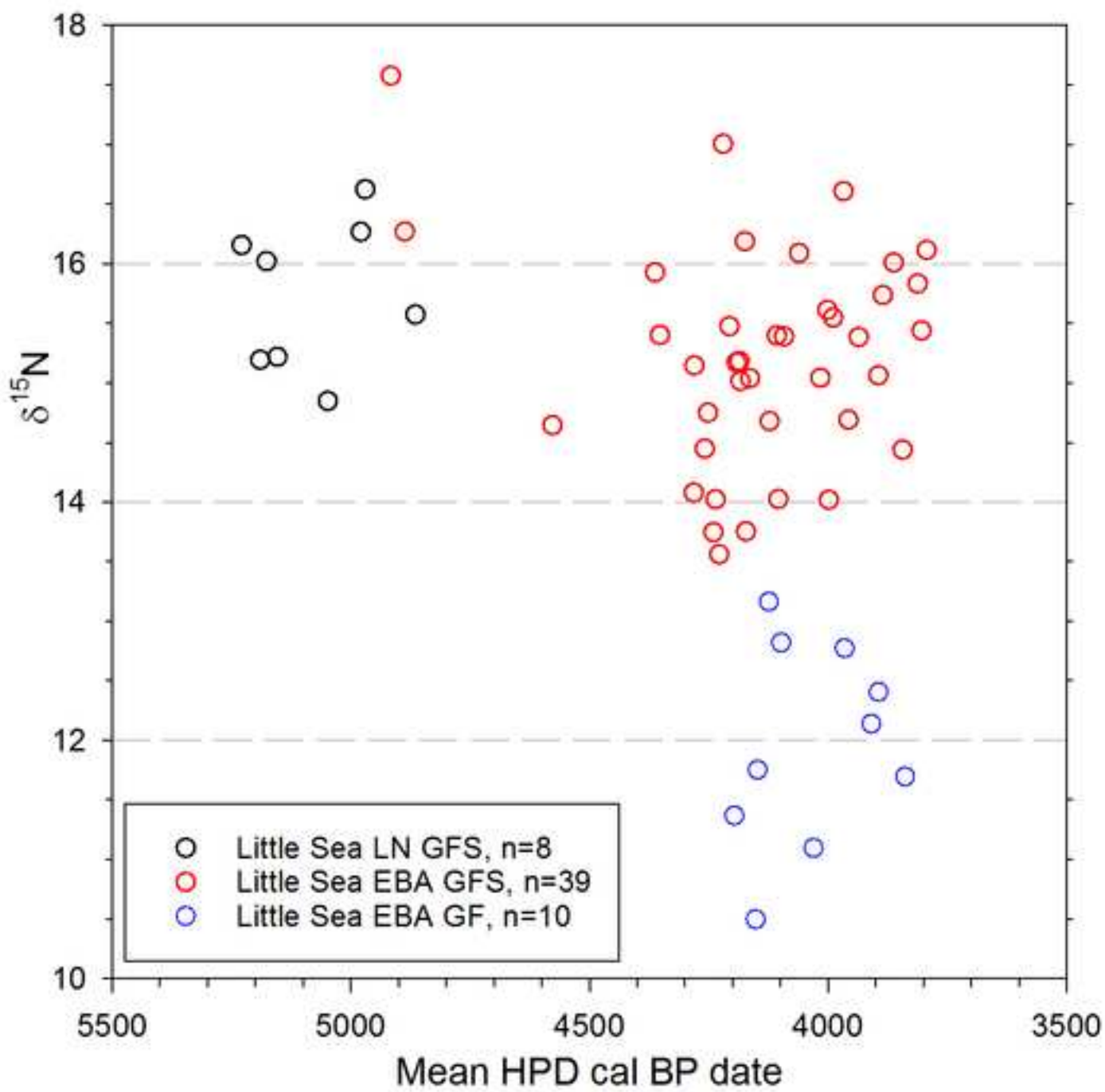


Figure 7A
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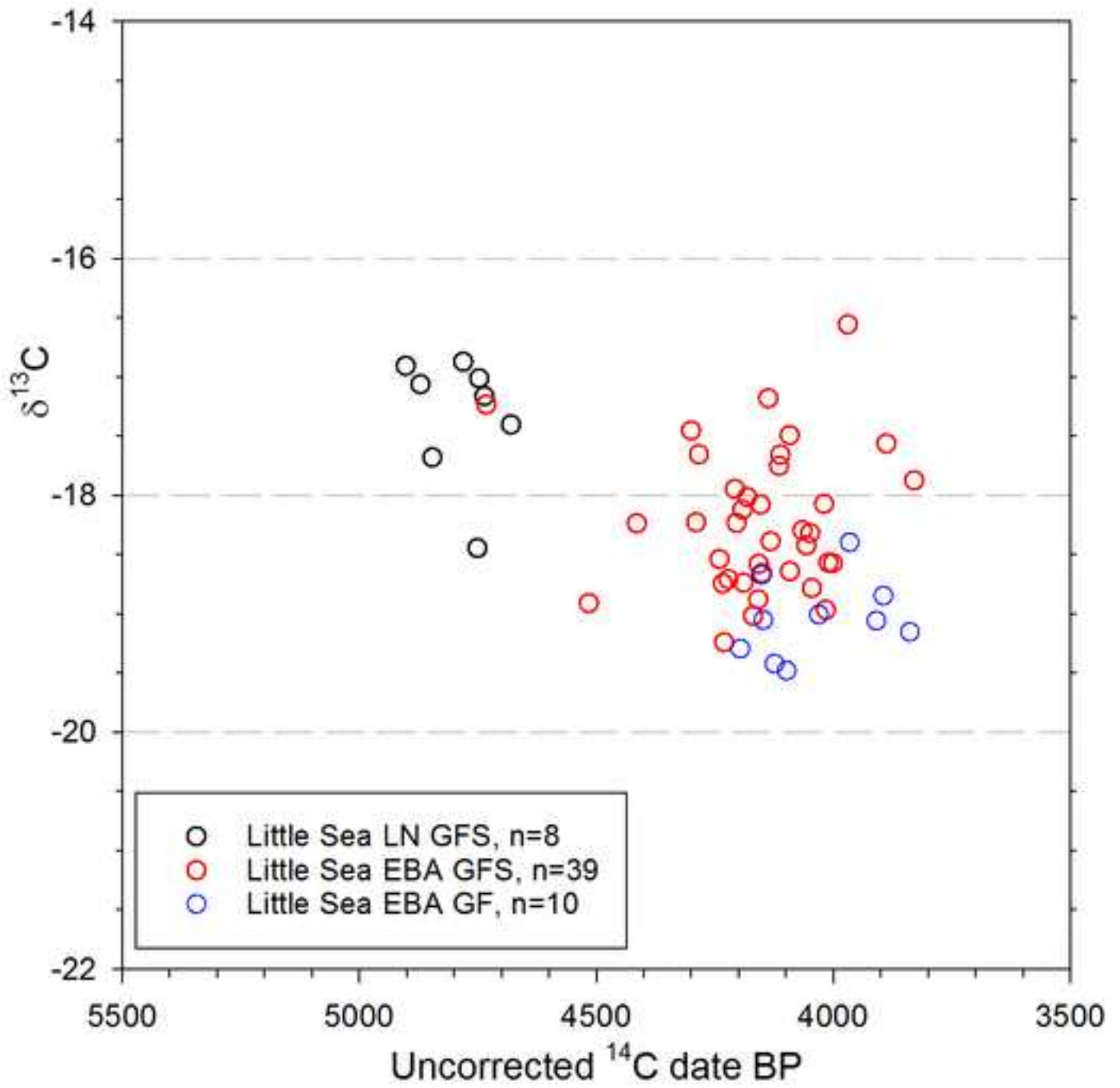


Figure 7B
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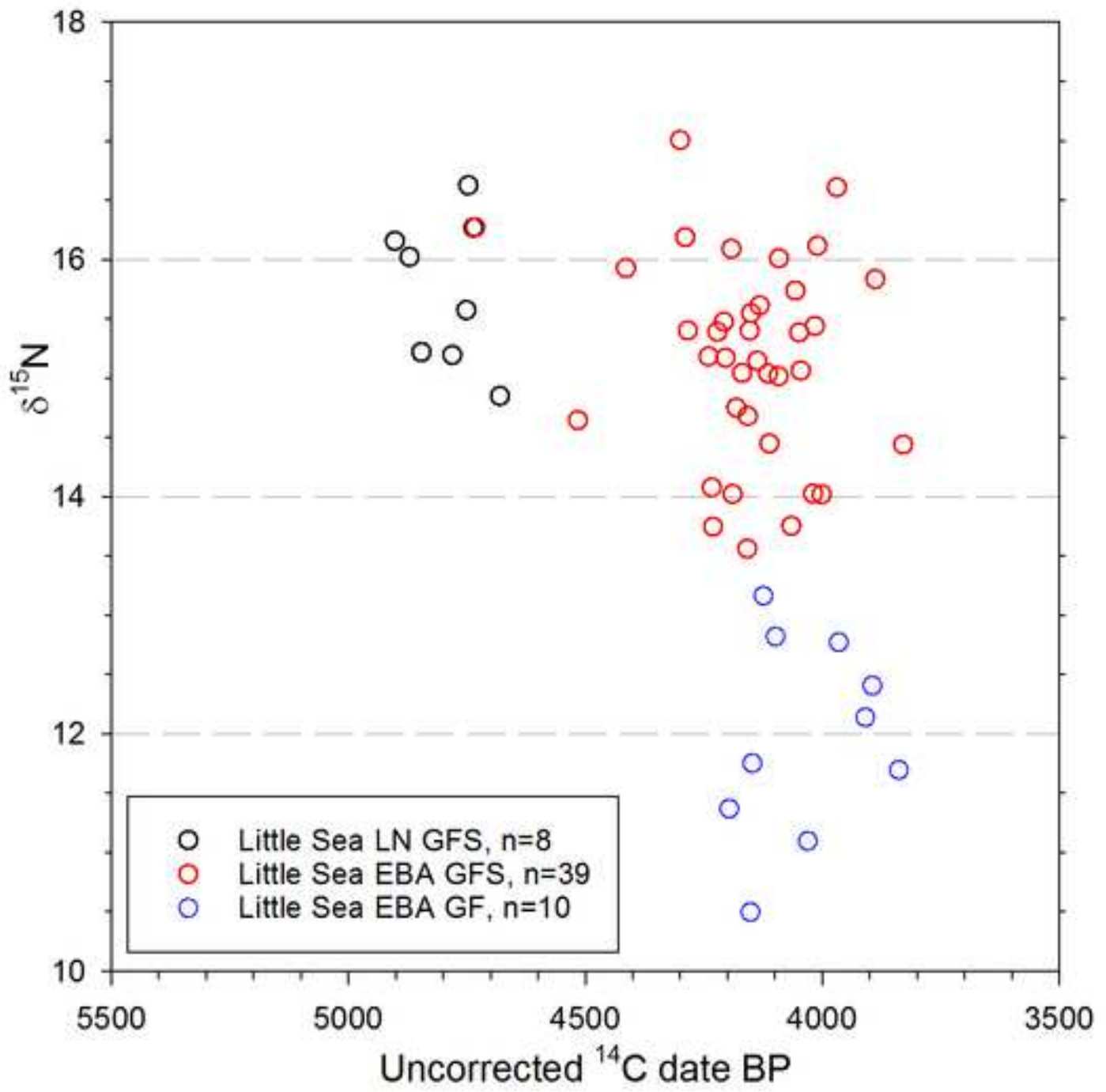


Table 1

Table 1

No.	Site	MASTER_ID	Date BP	σ	Corrected date BP	Corrected σ	Date difference	μ HPD date BP	μ HPD σ	Median date BP	Diet	Micro-region	Typological period	Phase	Lab comment
1	Kaiskaya Gora	KGO_2006.001.01	7755	40	7568	76	187	8332	80	8346		Angara	LM		
2	Khotoruk	KHO_1978.007	7657	39	7533	65	124	8309	69	8322	GF	Little Sea	LM or EN		
3	Kurma XI	KUR_2003.024	7474	37	7237	64	237	8060	65	8054	GFS	Little Sea	LM or EN		
4	Pad' Khinskaia	PKH_1936.001	7381	37	7060	74	321	7876	73	7881		Angara	LM		
5	Sarminskii Mys	SMS_1987.022	7078	38	6942	64	136	7778	69	7773	GF	Little Sea	LM or EN		
6	Kurma XI	KUR_2003.022	7019	36	6887	63	132	7729	65	7724	GF	Little Sea	LM or EN		
7	Khotoruk	KHO_1977.002.00	6722	36	6688	63	34	7571	43	7570	GF	Little Sea	LM or EN		
8	Khotoruk	KHO_1978.004.02	6790	37	6669	64	121	7561	41	7559	GFS	Little Sea	LM or EN		
9	Khotoruk	KHO_1978.005.01	6901	38	6621	64	280	7544	33	7544	GFS	Little Sea	LM or EN		
10	Ershi	ESH_1987.001	7067	37	6599	74	468	7544	34	7544		Angara	LM or EN		
11	Shamanka II	SHA_2005.066.01	6967	28	6653	70	314	7473	30	7474		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=1.8(5% 3.8)
12	Shamanka II	SHA_2006.073	7010	45	6631	78	379	7464	38	7468		SW Baikal	EN	1	
13	Shamanka II	SHA_2004.058.01	6980	28	6628	70	352	7468	33	7470		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.7(5% 3.8)
14	Shamanka II	SHA_2003.027.01	6939	33	6616	72	323	7463	37	7466		SW Baikal	EN	1	
15	Shamanka II	SHA_2006.076	7123	37	6614	74	509	7462	38	7465		SW Baikal	EN	1	
16	Shamanka II	SHA_2003.034	6970	35	6609	73	361	7461	39	7464		SW Baikal	EN	1	
17	Shamanka II	SHA_2007.085	6935	39	6607	75	328	7459	41	7463		SW Baikal	EN	1	
18	Shamanka II	SHA_2004.043	7046	35	6603	73	443	7459	40	7463		SW Baikal	EN	1	
19	Shamanka II	SHA_2002.021.02	6972	34	6586	73	386	7452	44	7458		SW Baikal	EN	1	
20	Shamanka II	SHA_2007.088	6910	35	6583	73	327	7450	45	7457		SW Baikal	EN	1	
21	Shamanka II	SHA_2007.093.02	7012	37	6581	74	431	7449	46	7456		SW Baikal	EN	1	
22	Shamanka II	SHA_2005.062.03	7022	39	6580	75	442	7447	47	7455		SW Baikal	EN	1	
23	Shamanka II	SHA_2006.077	7025	40	6573	76	452	7443	50	7452		SW Baikal	EN	1	
24	Shamanka II	SHA_2002.023.05	7021	35	6573	73	448	7445	48	7454		SW Baikal	EN	1	
25	Shamanka II	SHA_2004.045	6881	36	6568	74	313	7442	50	7451		SW Baikal	EN	1	
26	Shamanka II	SHA_2004.041			6567	53	378	7457	34	7458		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.0(5% 3.8)
27	Shamanka II	SHA_2006.079	7063	39	6565	75	498	7439	51	7450		SW Baikal	EN	1	
28	Lokomotiv-Raisovet	LOR_1991.007.01	6980	50	6559	81	421	7431	56	7444		Angara	EN		
29	Lokomotiv	LOK_1990.043.02	6905	35	6555	73	350	7435	52	7446		Angara	EN		
30	Shamanka II	SHA_2004.050.02	6875	26	6539	69	336	7427	54	7439		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=1.0(5% 3.8)
31	Lokomotiv	LOK_1990.041.02	6908	35	6535	73	373	7422	56	7435		Angara	EN		
32	Shamanka II	SHA_2004.044.02	6901	35	6533	73	368	7420	57	7433		SW Baikal	EN	1	
33	Shamanka II	SHA_2005.065	6945	45	6529	78	416	7415	59	7428		SW Baikal	EN	1	
34	Shamanka II	SHA_2004.057.00	7060	50	6528	81	532	7412	61	7426		SW Baikal	EN	1	
35	Ust' Ida	UID_1993.043	6910	45	6526	78	384	7413	60	7426		Angara	EN		
36	Shamanka II	SHA_2003.033	6913	34	6522	73	391	7412	58	7426		SW Baikal	EN	1	
37	Shamanka II	SHA_2005.062.04	7005	38	6521	75	484	7411	59	7424		SW Baikal	EN	1	
38	Shamanka II	SHA_2007.092	6867	35	6518	73	349	7409	59	7422		SW Baikal	EN	1	
39	Shamanka II	SHA_2006.074	6948	39	6516	75	432	7407	59	7419		SW Baikal	EN	1	
40	Shamanka II	SHA_2005.061.02	6915	38	6513	75	402	7405	60	7417		SW Baikal	EN	1	
41	Shamanka II	SHA_2002.022			6512	52	571	7414	50	7426		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.3(5% 3.8)
42	Shamanka II	SHA_1998.004	6906	38	6506	75	400	7400	60	7408		SW Baikal	EN	1	
43	Shamanka II	SHA_2005.062.01	6862	37	6505	74	357	7400	60	7407		SW Baikal	EN	1	
44	Shamanka II	SHA_2004.039			6500	42	399	7404	46	7418		SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.1(5% 3.8)

45	Shamanka II	SHA_2005.067	6885	40	6499	76	386	7395	61	7399	SW Baikal	EN	1	
46	Lokomotiv	LOK_1990.044.01	6929	35	6494	73	435	7392	59	7395	Angara	EN		
47	Shamanka II	SHA_2003.032	6921	35	6492	73	429	7391	59	7393	SW Baikal	EN	1	
48	Shamanka II	SHA_2006.069.02	6953	39	6488	75	465	7387	60	7389	SW Baikal	EN	1	
49	Lokomotiv	LOK_1990.042	6873	27	6484	70	389	7386	58	7387	Angara	EN		R_Combine, χ^2 -Test: df=1 T=0.1(5% 3.8)
50	Shamanka II	SHA_2002.024.02	6901	34	6479	73	422	7382	59	7383	SW Baikal	EN	1	
51	Shamanka II	SHA_2005.063.02	6908	32	6474	72	434	7379	59	7380	SW Baikal	EN	1	
52	Shamanka II	SHA_2004.055.02	7017	39	6472	75	545	7377	60	7379	SW Baikal	EN	1	
53	Shamanka II	SHA_2004.048.01			6469	51	459	7376	46	7377	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=1.5(5% 3.8)
54	Shamanka II	SHA_2005.060.02	6959	39	6456	75	503	7367	60	7370	SW Baikal	EN	1	
55	Lokomotiv-Raisovet	LOR_1998.014	6915	40	6448	76	467	7362	61	7365	Angara	EN		
56	Shamanka II	SHA_2007.090	7000	40	6445	76	555	7361	62	7364	SW Baikal	EN	1	
57	Shamanka II	SHA_2004.055.01	6881	38	6440	75	441	7358	61	7362	SW Baikal	EN	1	
58	Shamanka II	SHA_2004.050.03	6911	26	6439	69	472	7358	57	7361	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=5.8(5% 3.8)
59	Shamanka II	SHA_2006.069.01	6899	35	6436	73	463	7356	60	7360	SW Baikal	EN	1	
60	Lokomotiv	LOK_1980.022.03			6435	54	442	7358	47	7361	Angara	EN		R_Combine, χ^2 -Test: df=1 T=0.1(5% 3.8)
61	Shamanka II	SHA_2004.056.02	6986	27	6433	70	553	7355	58	7359	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=3.5(5% 3.8)
62	Shamanka II	SHA_2004.047			6432	51	595	7357	46	7360	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=1.1(5% 3.8)
63	Shamanka II	SHA_2006.075	7093	37	6431	74	662	7353	61	7357	SW Baikal	EN	1	
64	Lokomotiv	LOK_1984.029	6894	36	6430	74	464	7352	61	7357	Angara	EN		
65	Shamanka II	SHA_2002.025.01	6897	35	6429	73	468	7352	61	7356	SW Baikal	EN	1	
66	Lokomotiv	LOK_1980.002.02	6838	36	6428	74	410	7351	62	7356	Angara	EN		
67	Lokomotiv	LOK_1980.002.03	6829	34	6421	73	408	7347	62	7352	Angara	EN		
68	Shamanka II	SHA_2004.054.01	6939	38	6417	75	522	7344	64	7349	SW Baikal	EN	1	
69	Shamanka II	SHA_2004.053.02	7001	38	6412	75	589	7341	65	7347	SW Baikal	EN	1	
70	Lokomotiv-Raisovet	LOR_1980.003.01	6808	37	6411	74	397	7341	64	7346	Angara	EN		
71	Shamanka II	SHA_2004.046			6411	53	666	7347	50	7350	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.0(5% 3.8)
72	Shamanka II	SHA_2006.083.02	7095	36	6402	74	693	7335	66	7340	SW Baikal	EN	1	
73	Shamanka II	SHA_2005.061.01	6881	40	6399	76	482	7333	68	7337	SW Baikal	EN	1	
74	Shamanka II	SHA_2005.062.02	6895	37	6391	74	504	7328	69	7331	SW Baikal	EN	1	
75	Lokomotiv	LOK_1981.024.01	6793	36	6388	74	405	7326	70	7329	Angara	EN		
76	Lokomotiv	LOK_1985.033	6827	34	6388	73	439	7326	69	7329	Angara	EN		
77	Shamanka II	SHA_2006.071	6838	27	6384	70	454	7324	68	7326	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.7(5% 3.8)
78	Lokomotiv	LOK_1988.038.02	6836	38	6383	75	453	7321	72	7325	Angara	EN		
79	Lokomotiv-Raisovet	LOR_1998.013.01	6770	40	6380	76	390	7319	74	7322	Angara	EN		
80	Shamanka II	SHA_2006.070	6819	37	6374	74	445	7315	74	7317	SW Baikal	EN	1	
81	Shamanka II	SHA_2003.026.02	6490	34	6373	73	117	7314	73	7316	SW Baikal	EN	1	
82	Lokomotiv	LOK_1981.025.05	6775	45	6369	78	406	7309	78	7312	Angara	EN		
83	Lokomotiv	LOK_1981.024.04	6775	40	6367	76	408	7308	77	7311	Angara	EN		
84	Shamanka II	SHA_2005.068	6889	37	6367	74	522	7309	76	7311	SW Baikal	EN	1	
85	Shamanka II	SHA_2004.051	6856	40	6356	76	500	7298	81	7301	SW Baikal	EN	1	
86	Lokomotiv	LOK_1988.038.01	6882	37	6355	74	527	7298	79	7300	Angara	EN		
87	Shamanka II	SHA_2004.053.01	6928	37	6347	74	581	7290	82	7292	SW Baikal	EN	1	
88	Kitoi	KIT_surface	6879	37	6344	74	535	7287	83	7289	Angara	EN		
89	Shamanka II	SHA_2004.052.02	6892	37	6341	74	551	7283	83	7285	SW Baikal	EN	1	
90	Lokomotiv	LOK_1981.025.01	6748	35	6329	73	419	7270	86	7271	Angara	EN		
91	Lokomotiv-Raisovet	LOR_1980.001	6800	40	6320	76	480	7259	91	7261	Angara	EN		

92	Shamanka II	SHA_2004.052.01	6845	40	6320	76	525	7259	91	7261	SW Baikal	EN	1	
93	Lokomotiv	LOK_1985.034	6748	36	6298	74	450	7232	93	7236	Angara	EN		
94	Shamanka II	SHA_2005.059.02	6694	39	6296	75	398	7229	94	7234	SW Baikal	EN	1	
95	Shamanka II	SHA_2001.016	6826	25	6292	69	534	7224	88	7228	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.4(5% 3.8)
96	Shamanka II	SHA_2008.108.02	6816	32	6286	72	530	7216	92	7222	SW Baikal	EN	1	
97	Lokomotiv	LOK_1980.022.02	6804	28	6285	70	519	7215	90	7221	Angara	EN		R_Combine, χ^2 -Test: df=1 T=0.0(5% 3.8)
98	Shamanka II	SHA_2007.096.02	6684	26	6282	69	402	7211	89	7218	SW Baikal	EN	1	R_Combine, χ^2 -Test: df=1 T=0.0(5% 3.8)
99	Shamanka II	SHA_2005.063.01	6815	38	6278	75	537	7206	95	7215	SW Baikal	EN	1	
100	Lokomotiv	LOK_1980.007	6711	35	6274	73	437	7201	94	7211	Angara	EN		
101	Shamanka II	SHA_2008.112	6782	38	6272	75	510	7199	96	7209	SW Baikal	EN	1	
102	Kitoi	KIT_1880.004	6660	35	6269	73	391	7195	94	7205	Angara	EN		
103	Lokomotiv	LOK_1981.025.03	6779	34	6267	73	512	7192	94	7203	Angara	EN		
104	Galashikha	GAL_Grave17-2	6685	36	6266	74	419	7191	95	7202	Angara	EN		
105	Lokomotiv	LOK_1988.039	6713	35	6250	73	463	7171	94	7185	Angara	EN		
106	Shamanka II	SHA_2007.086.02	6815	35	6244	73	571	7164	94	7177	SW Baikal	EN	1	
107	Shamanka II	SHA_2006.083.01	6620	40	6240	76	380	7160	96	7173	SW Baikal	EN	1	
108	Kitoi	KIT_1880.011	6706	35	6233	73	473	7151	93	7164	Angara	EN		
109	Lokomotiv	LOK_1980.006	6751	35	6229	73	522	7147	93	7159	Angara	EN		
110	Ust' Belaia	UBE_1962.005	6710	33	6224	72	486	7141	92	7152	Angara	EN		
111	Lokomotiv	LOK_1985.030.01	6570	34	6217	73	353	7134	92	7141	Angara	EN		
112	Shamanka II	SHA_2005.060.01	6819	38	6206	75	613	7124	94	7125	SW Baikal	EN	1	
113	Shamanka II	SHA_2007.086.01	6584	39	6205	75	379	7123	94	7124	SW Baikal	EN	1	
114	Ust' Belaia	UBE_1962.008	6694	34	6188	73	506	7106	91	7108	Angara	EN		
115	Galashikha	GAL_Grave18	6690	36	6176	74	514	7095	92	7098	Angara	EN		
116	Galashikha	GAL_Grave17-1	6655	35	6172	73	483	7091	92	7095	Angara	EN		
117	Shumilikha	SHU_1972.002.01	6664	37	6167	74	497	7087	93	7092	Angara	EN		
118	Lokomotiv	LOK_1981.025.02	6678	35	6161	73	517	7081	93	7086	Angara	EN		
119	Ust' Belaia	UBE_1962.009.00	6640	32	6141	72	499	7063	94	7070	Angara	EN		
120	Lokomotiv	LOK_1981.024.05	6580	36	6133	74	447	7055	97	7063	Angara	EN		
121	Lokomotiv	LOK_1980.009	6573	34	6128	73	445	7050	97	7057	Angara	EN		
122	Lokomotiv	LOK_1981.023	6695	40	6118	76	577	7041	101	7047	Angara	EN		
123	Galashikha	GAL_Grave05-1	6640	35	6095	73	545	7015	104	7010	Angara	EN		
124	Galashikha	GAL_Grave16	6540	35	6079	73	461	6996	106	6987	Angara	EN		
125	Galashikha	GAL_Grave04(1978)	6586	34	6049	73	537	6958	108	6945	Angara	EN		
126	Galashikha	GAL_Grave05-2	6592	36	6044	74	548	6953	108	6940	Angara	EN		
127	Shamanka II	SHA_2004.049.01			6041	52	306	6918	83	6912	SW Baikal	EN	2	R_Combine, χ^2 -Test: df=1 T=0.4(5% 3.8)
128	Lokomotiv	LOK_1985.035	6615	40	6041	76	574	6952	109	6939	Angara	EN		
129	Galashikha	GAL_Grave03	6496	35	6033	73	463	6937	106	6926	Angara	EN		
130	Galashikha	GAL_Grave07	6573	36	6028	74	545	6932	106	6921	Angara	EN		
131	Shamanka II	SHA_1999.007	6329	33	6001	72	328	6896	98	6886	SW Baikal	EN	2	
132	Shamanka II	SHA_2004.050.01	6405	25	5981	69	424	6869	88	6863	SW Baikal	EN	2	R_Combine, χ^2 -Test: df=1 T=0.3(5% 3.8)
133	Shamanka II	SHA_2008.104	6312	25	5977	69	335	6865	87	6859	SW Baikal	EN	2	R_Combine, χ^2 -Test: df=1 T=5.0(5% 3.8)
134	Shamanka II	SHA_2008.108.01	6395	32	5955	72	440	6848	86	6844	SW Baikal	EN	2	
135	Shamanka II	SHA_2003.030	6338	33	5953	72	385	6846	85	6842	SW Baikal	EN	2	
136	Shamanka II	SHA_2004.044.01			5952	52	532	6819	62	6821	SW Baikal	EN	2	R_Combine, χ^2 -Test: df=1 T=0.2(5% 3.8)
137	Roshcha Zvezdochka	ROZ_2008.003	6590	36	5939	74	651	6836	85	6834	Angara	EN		
138	Shamanka II	SHA_2004.042.01	6386	34	5921	73	465	6820	80	6819	SW Baikal	EN	2	
139	Shamanka II	SHA_2008.108.03	6373	32	5915	72	458	6813	78	6811	SW Baikal	EN	2	

140	Shamanka II	SHA_2005.064.01	6381	37	5902	74	479	6806	78	6800	SW Baikal	EN	2	
141	Shamanka II	SHA_2003.035.01	6396	33	5877	72	519	6785	73	6777	SW Baikal	EN	2	
142	Shamanka II	SHA_1998.006	6483	37	5875	74	608	6786	74	6778	SW Baikal	EN	2	
143	Shamanka II	SHA_2005.059.01	6450	38	5835	75	615	6762	70	6754	SW Baikal	EN	2	
144	Isakovo	ISA_1932.002	4913	31	4715	71	198	5424	84	5413	Angara	LN		
145	Ust' Ida	UID_1989.025.03	4903	31	4710	71	193	5421	84	5411	Angara	LN		
146	Ust' Ida	UID_1988.018	4890	30	4710	71	180	5421	84	5411	Angara	LN		
147	Ust' Ida	UID_1991.038	4833	39	4670	75	163	5386	104	5392	Angara	LN		
148	Ust' Ida	UID_1987.008	4824	32	4666	72	158	5386	102	5392	Angara	LN		
149	Ust' Ida	UID_1991.041	4876	33	4663	72	213	5382	104	5391	Angara	LN		
150	Ust' Ida	UID_1989.020.02	4854	39	4655	75	199	5369	114	5384	Angara	LN		
151	Ust' Ida	UID_1994.052	4965	30	4644	71	321	5359	115	5379	Angara	LN		
152	Ust' Ida	UID_1994.054	4857	37	4617	74	240	5310	133	5330	Angara	LN		
153	Ust' Ida	UID_1989.021.02	4921	29	4597	70	324	5275	135	5299	Angara	LN		
154	Ust' Ida	UID_1987.005	4852	35	4596	73	256	5271	137	5294	Angara	LN		
155	Ust' Ida	UID_1989.020.01	4885	30	4584	71	301	5250	134	5262	Angara	LN		
156	Ust' Ida	UID_1989.026.05	4749	36	4578	74	171	5238	135	5240	Angara	LN		
157	Shamanski Mys	SHM_1976.001.01	4902	33	4572	61	330	5229	123	5226	GFS	Little Sea	LN	
158	Ust' Ida	UID_1994.053.01	4791	30	4548	71	243	5194	122	5181	Angara	LN		
159	Sarminskii Mys	SMS_1986.019.05	4781	33	4546	61	235	5190	110	5176	GFS	Little Sea	LN	
160	Sarminskii Mys	SMS_1987.029.02	4871	31	4534	60	337	5177	105	5168	GFS	Little Sea	LN	
161	Sarminskii Mys	SMS_1986.019.01	4846	33	4507	61	339	5154	103	5156	GFS	Little Sea	LN	
162	Sarminskii Mys	SMS_1986.017	4680	32	4412	61	268	5048	123	5021	GFS	Little Sea	LN	
163	Sarminskii Mys	SMS_1986.011.01	4736	33	4363	61	373	4979	107	4954	GFS	Little Sea	LN	
164	Sarminskii Mys	SMS_1986.011.04	4747	29	4359	59	388	4970	101	4948	GFS	Little Sea	LN	
165	Sarminskii Mys	SMS_1986.019.02	4751	32	4283	61	468	4865	95	4861	GFS	Little Sea	LN	
166	Shamanski Mys	SHM_1975.001			4410	43	514	4916	42	4906	GFS	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=0.5(5% 3.8)
167	Sarminskii Mys	SMS_1986.009	4732	32	4350	61	382	4887	57	4884	GFS	Little Sea	EBA	
168	Ust' Ida	UID_1991.042	4551	31	4248	71	303	4726	97	4721	Angara	EBA		
169	Gorodishche II	GO2_1996.003	4556	32	4221	72	335	4699	93	4699	Angara	EBA		
170	Gorodishche II	GO2_1996.004	4445	31	4171	71	274	4663	95	4662	Angara	EBA		
171	Gorodishche II	GO2_1995.002	4543	31	4145	71	398	4643	99	4640	Angara	EBA		
172	Obkhoi	OBK_1976.003	4391	32	4138	51	253	4654	88	4648	Upper Lena	EBA		
173	Kurma XI	KUR_2002.009	4515	21	4076	56	439	4577	101	4562	GFS	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=1.3(5% 3.8)
174	Obkhoi	OBK_1971.013	4352	31	4021	51	331	4496	79	4486	Upper Lena	EBA		
175	Makrushino	MAK_1992.018	4490	31	3986	51	504	4447	78	4452	Upper Lena	EBA		
176	Kurma XI	KUR_2003.025	4414	30	3938	60	476	4362	91	4361	GFS	Little Sea	EBA	
177	Kurma XI	KUR_2003.026	4283	27	3930	58	353	4352	87	4352	GFS	Little Sea	EBA	
178	Makrushino	MAK_1992.019	4199	30	3917	50	282	4338	75	4339	Upper Lena	EBA		
179	Obkhoi	OBK_1971.003.02	3950	30	3911	50	39	4332	75	4333	Upper Lena	EBA		
180	Badai	BAD_1920.000	4052	29	3898	70	154	4308	99	4311	Angara	EBA		
181	Ust' Belaia	UBE_1957.002	4073	21	3893	67	180	4304	95	4308	Angara	EBA		R_Combine, χ^2 -Test: df=1 T=1.9(5% 3.8)
182	Obkhoi	OBK_1971.001.02			3892	35	222	4323	59	4326	Upper Lena	EBA		R_Combine, χ^2 -Test: df=1 T=1.3(5% 3.8)
183	Makrushino	MAK_1992.013.00	4242	30	3892	50	350	4312	76	4316	Upper Lena	EBA		
184	Kurma XI	KUR_2003.018	4233	31	3869	60	364	4281	90	4284	GFS	Little Sea	EBA	
185	Khadarta IV	KHA_2010.011	4137	31	3868	60	269	4280	90	4283	GFS	Little Sea	EBA	

186	Obkhoi	OBK_1971.001.03	3999	30	3856	50	143	4272	82	4272		Upper Lena	EBA	
187	Makarovo	MKV_1973.001	4215	32	3853	51	362	4267	84	4267		Upper Lena	EBA	
188	Obkhoi	OBK_1971.007	4073	30	3852	50	221	4267	83	4266		Upper Lena	EBA	
189	Khadarta IV	KHA_2010.015	4111	31	3849	60	262	4258	93	4258	GFS	Little Sea	EBA	
190	Kurma XI	KUR_2002.007.01	4181	36	3845	63	336	4251	97	4251	GFS	Little Sea	EBA	
191	Kulgana	KUL_1977.000	4230	31	3835	60	395	4240	96	4238	GFS	Little Sea	EBA	
192	Kurma XI	KUR_2002.013	4189	31	3831	60	358	4235	96	4232	GFS	Little Sea	EBA	
193	Kurma XI	KUR_2002.014	4158	28	3826	59	332	4228	96	4225	GFS	Little Sea	EBA	
194	Obkhoi	OBK_1971.001.01	4121	18	3821	44	300	4223	80	4215		Upper Lena	EBA	R_Combine, χ^2 -Test: df=2 T=1.1(5% 6.0)
195	Kurma XI	KUR_2002.010	4300	26	3820	58	480	4220	96	4215	GFS	Little Sea	EBA	
196	Kurma XI	KUR_2002.003	4207	33	3811	61	396	4206	100	4203	GFS	Little Sea	EBA	
197	Kurma XI	KUR_2002.012	3979	33	3804	61	175	4196	101	4193	GF	Little Sea	EBA	
198	Kurma XI	KUR_2002.005	4204	31	3801	60	403	4191	100	4189	GFS	Little Sea	EBA	
199	Obkhoi	OBK_1971.004.01	4089	29	3800	50	289	4189	88	4187		Upper Lena	EBA	
200	Ust' Ida	UID_1991.039	3890	33	3798	72	92	4185	113	4183		Angara	EBA	
201	Kurma XI	KUR_2002.007.02	4240	34	3797	62	443	4185	102	4182	GFS	Little Sea	EBA	
202	Sarminskii Mys	SMS_1986.012	4092	30	3796	60	296	4183	100	4181	GFS	Little Sea	EBA	
203	Obkhoi	OBK_1971.003.01	4070	31	3796	51	274	4183	89	4181		Upper Lena	EBA	
204	Kurma XI	KUR_2003.017	4289	25	3790	58	499	4174	98	4172	GFS	Little Sea	EBA	
205	Sarminskii Mys	SMS_1987.033	4065	27	3789	58	276	4172	98	4170	GFS	Little Sea	EBA	
206	Khadarta IV	KHA_2010.005	4114	31	3783	60	331	4163	100	4160	GFS	Little Sea	EBA	
207	Khuzhir-Nuge XIV	K14_2000.077	3790	21	3776	56	14	4151	94	4148	GF	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=0.3(5% 3.8)
208	Kurma XI	KUR_2002.001	3954	31	3773	60	181	4147	99	4144	GF	Little Sea	EBA	
209	Obkhoi	OBK_1971.004.02	4000	29	3773	50	227	4144	86	4143		Upper Lena	EBA	
210	Kurma XI	KUR_2003.019	4121	25	3759	58	362	4124	95	4122	GF	Little Sea	EBA	
211	Kurma XI	KUR_2002.006	4157	32	3757	61	400	4122	98	4120	GFS	Little Sea	EBA	
212	Shamanski Mys	SHM_1973.001	4153	32	3747	61	406	4107	96	4105	GFS	Little Sea	EBA	
213	Khadarta IV	KHA_2010.009	4019	31	3745	60	274	4104	95	4102	GFS	Little Sea	EBA	
214	Obkhoi	OBK_1971.014.02	3929	29	3742	50	187	4095	80	4097		Upper Lena	EBA	
215	Kurma XI	KUR_2002.015	4078	30	3741	60	337	4098	94	4096	GF	Little Sea	EBA	
216	Sarminskii Mys	SMS_1986.013	4221	31	3737	60	484	4092	93	4090	GFS	Little Sea	EBA	
217	Obkhoi	OBK_1971.014.01	3977	30	3736	50	241	4087	79	4088		Upper Lena	EBA	
218	Khadarta IV	KHA_2010.008	4191	30	3714	60	477	4060	88	4055	GFS	Little Sea	EBA	
219	Manzurka	MNZ_1974.004.01	3985	29	3706	50	279	4047	74	4044		Upper Lena	EBA	
220	Ust' lamnaia	UIA_1977.005	4137	30	3691	50	446	4029	73	4030		Upper Lena	EBA	
221	Khuzhir-Nuge XIV	K14_1998.037.01	3803	31	3690	60	113	4030	85	4029	GF	Little Sea	EBA	
222	Kurma XI	KUR_2002.016	4169	27	3679	58	490	4016	82	4015	GFS	Little Sea	EBA	
223	Kurma XI	KUR_2002.004	4132	22	3667	56	465	4001	79	3998	GFS	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=0.3(5% 3.8)
224	Khadarta IV	KHA_2010.012	4001	29	3664	59	337	3998	82	3994	GFS	Little Sea	EBA	
225	Shamanski Mys	SHM_1973.002	4150	30	3657	60	493	3989	83	3984	GFS	Little Sea	EBA	
226	Ust' lamnaia	UIA_surface	3957	29	3641	50	316	3968	72	3961		Upper Lena	EBA	
227	Khuzhir-Nuge XIV	K14_1999.057.02	3969	29	3639	59	330	3967	82	3961	GFS	Little Sea	EBA	
228	Khuzhir-Nuge XIV	K14_2001.087	3833	30	3637	60	196	3965	83	3958	GF	Little Sea	EBA	
229	Shamanski Mys	SHM_1972.002			3634	43	436	3957	65	3950	GFS	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=0.4(5% 3.8)
230	Ulus Khalskii	UKH_1930.000	3991	30	3619	50	372	3940	72	3934		Upper Lena	EBA	
231	Khadarta IV	KHA_2003.003	4048	22	3614	56	434	3935	79	3930	GFS	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=1.4(5% 3.8)
232	Obkhoi	OBK_1971.005	3888	31	3608	51	280	3926	73	3921		Upper Lena	EBA	
233	Manzurka	MNZ_1974.001	3938	29	3595	50	343	3908	71	3905		Upper Lena	EBA	

234	Sarminskii Mys	SMS_1987.021	3813	27	3594	58	219	3909	81	3906	GF	Little Sea	EBA	
235	Shamanka II	SHA_2000.009	3886	21	3593	67	293	3911	90	3907		SW Baikal	EBA	R_Combine, χ^2 -Test: df=1 T=0.5(5% 3.8)
236	Shamanski Mys	SHM_1972.001.01	4045	31	3582	60	463	3894	83	3892	GFS	Little Sea	EBA	
237	Khuzhir-Nuge XIV	K14_1998.036.01	3800	30	3582	60	218	3894	83	3892	GF	Little Sea	EBA	
238	Shamanka II	SHA_2008.103.02	3746	28	3578	70	168	3894	92	3890		SW Baikal	EBA	
239	Shamanski Mys	SHM_1973.004	4056	30	3575	60	481	3885	82	3883	GFS	Little Sea	EBA	
240	Khadarta IV	KHA_2010.007	4091	31	3556	60	535	3862	79	3861	GFS	Little Sea	EBA	
241	Khuzhir-Nuge XIV	K14_1999.045	3829	29	3540	59	289	3843	75	3842	GFS	Little Sea	EBA	
242	Borki	BO1_1971.002	3742	30	3539	50	203	3834	67	3838		Upper Lena	EBA	
243	Khuzhir-Nuge XIV	K14_1998.037.02	3727	22	3538	56	189	3838	71	3839	GF	Little Sea	EBA	R_Combine, χ^2 -Test: df=1 T=3.4(5% 3.8)
244	Obkhoi	OBK_1971.010	3922	28	3535	49	387	3829	65	3833		Upper Lena	EBA	
245	Shamanka II	SHA_2008.107	3764	20	3531	67	233	3841	79	3837		SW Baikal	EBA	R_Combine, χ^2 -Test: df=1 T=0.0(5% 3.8)
246	Borki	BO2_1971.002			3506	36	283	3792	46	3792		Upper Lena	EBA	R_Combine, χ^2 -Test: df=1 T=3.2(5% 3.8)
247	Khuzhir-Nuge XIV	K14_1999.049	3888	30	3506	60	382	3812	66	3810	GFS	Little Sea	EBA	
248	Borki	BO1_1971.001	3844	29	3503	50	341	3801	56	3800		Upper Lena	EBA	
249	Glazkovo	GLZ_1887.006	3684	29	3502	70	182	3819	74	3815		Angara	EBA	
250	Khadarta IV	KHA_2010.006	4015	30	3494	60	521	3804	63	3802	GFS	Little Sea	EBA	
251	Shamanka II	SHA_2008.109	3724	33	3490	72	234	3813	72	3809		SW Baikal	EBA	
252	Shamanka II	SHA_2008.103.01	3650	28	3486	70	164	3809	69	3806		SW Baikal	EBA	
253	Borki	BO2_1971.003	3740	29	3475	50	265	3785	51	3790		Upper Lena	EBA	
254	Shamanski Mys	SHM_1973.003.01	4010	30	3474	60	536	3793	58	3795	GFS	Little Sea	EBA	
255	Ust' Ida	UID_1994.048	3854	30	3437	71	417	3786	61	3791		Angara	EBA	
256	Shamanka II	SHA_2008.111	3700	33	3409	72	291	3777	60	3785		SW Baikal	EBA	

Note: records are grouped by "Typological period" and sorted by "Corrected date BP".

Records removed from chronological analysis.

257	Lokomotiv-Raisovet	LOR_1997.011	6923	27	6384	70	539					Angara	EN	R_Combine, χ^2 -Test: df=1 T=11.1(5% 3.8)
258	Shamanka II	SHA_2004.042.02			6890	52	-83					SW Baikal	EN	
259	Shamanka II	SHA_2008.106	2633	27	2583	70	50					SW Baikal	LBA	
260	Iushino I	IUSH_0000.000	5165	32	4567	186	598					Upper Lena	LM or EN	
261	Iushino	IUSH_2007.000.00	6897	28	6366	186	531					Upper Lena	LM or EN	
262	Manzurka	MNZ_1974.002	5189	32	4632	186	557					Upper Lena	LM or EN	
263	Nikolskii Grot	NGT_1982.001.01	8070	45	7465	189	605					Upper Lena	LN	
264	Nikolskii Grot	NGT_1982.001.02	6983	38	6194	188	789					Upper Lena	LN	
265	Nikolskii Grot	NGT_1982.002.01	6980	40	6067	188	913					Upper Lena	LN	
266	Nikolskii Grot	NGT_surface	7136	35	6406	187	730					Upper Lena	LN	
267	Popovskii Lug 2	POP2_2010.001	6618	35	5935	187	683					Upper Lena	LM or EN	
268	Turuka	TUR_1992.002	6795	36	6290	187	505					Upper Lena	EN	
269	Turuka	TUR_1992.004	5289	33	4611	187	678					Upper Lena	EN	
270	Turuka	TUR_1993.005	5214	33	4637	187	577					Upper Lena	EN	
271	Zakuta	ZAK_1993.001	5121	30	4694	186	427					Upper Lena	LN	
272	Zakuta	ZAK_1994.002	5189	30	4657	186	532					Upper Lena	LN	
273	Zakuta	ZAK_1994.003	5136	32	4408	186	728					Upper Lena	LN	
274	Zakuta	ZAK_1994.005	4926	33	4247	187	679					Upper Lena	LN	
275	Zapleskino	ZAP_0000.003	5138	31	4604	186	534					Upper Lena	LN	

Table 2

Micro-region	LM	LM or EN	EN	LN	EBA	Row totals
Angara	2	1	50	14	9	76
Little Sea		7		8	49	64
SW Baikal			83		6	89
Upper Lena					27	27
Column totals	2	8	133	22	91	256

Table 3

Cis-Baikal	TRAPEZIUM DISTRIBUTION MODEL			UNIFORM DISTRIBUTION MODEL		
	<i>68.2% cal y BP</i>	<i>95.4% cal y BP</i>	$\mu \pm \sigma$	<i>68.2% cal y BP</i>	<i>95.4% cal y BP</i>	$\mu \pm \sigma$
LM Start	8418–8069	8609–7967	8277±176	8510–8282	8672–8217	8428±124
LM End	7516–7488	7532–7475	7503±14	7529–7499	7553–7486	7516±16
LM Span	793–913	687–965	842±67	702–892	663–926	811±70
LM Interval	564–913	465–1109	774±176	781–994	695–1158	912±125
EN Start	7516–7488	7532–7475	7503±14	7529–7499	7553–7486	7516±16
EN End	7065–6999	7090–6958	7027±33	6842–6780	6861–6740	6805±31
EN Span	764–850	722–897	809±43	660–731	637–776	701±35
EN Interval	433–508	407–552	476±37	669–743	644–788	711±36
MN Start	7065–6999	7090–6958	7027±33	6842–6780	6861–6740	6805±31
MN End	5626–5471	5759–5413	5571±88	5547–5436	5629–5402	5506±59
MN Span	n/a	n/a	n/a	n/a	n/a	n/a
MN Interval	1389–1562	1258–1630	1456±94	1245–1377	1163–1422	1300±66
LN Start	5626–5471	5759–5413	5571±88	5547–5436	5629–5402	5506±59
LN End	4674–4524	4747–4438	4597±76	4918–4873	4950–4860	4901±24
LN Span	588–738	513–873	679±87	482–597	443–674	549±58
LN Interval	839–1078	728–1238	973±126	529–658	484–741	604±66
EBA Start	4674–4524	4747–4438	4597±76	4918–4873	4950–4860	4901±24
EBA End	3760–3694	3795–3657	3726±34	3733–3672	3760–3629	3698±32
EBA Span	1153–1263	1115–1336	1218±56	1138–1207	1108–1253	1177±35
EBA Interval	783–963	683–1048	871±91	1159–1239	1125–1289	1204±41

Supplement 1

Supplement 1

No.	Project	P	Site	MASTER_ID	Age	Sex	Sample	OxA	Date BP	σ	%Yld	%C	$\delta^{13}C$	$\delta^{15}N$	CN	Typological period	References
Angara																	
1	4163	34448	Badai	BAD_1920.000	20+ y.	U	H 2013.008	28748	4052	29	4.6	43.7	-18.0	12.3	3.3	EBA	V.I. Bazaliskii pers. comm.
2	4307	36267	Ershi	ESH_1987.001	20+ y.	U	H 2013.019	30596	7067	37	18.2	41.9	-15.8	14.8	3.3	LM or EN	Bazaliskii, 2010
3	3590	29491	Galashikha	GAL_Grave03	20+ y.	U	H 2000.498	25112	6496	35	3.3	44.8	-15.1	14.8	3.3	EN	Berdnikova, 2001
4	3590	29492	Galashikha	GAL_Grave04(1978)	20+ y.	U	H 2000.499	25113	6586	34	4.5	44.6	-15.3	15.4	3.3	EN	Berdnikova, 2001
5	3590	29493	Galashikha	GAL_Grave05-1	20+ y.	U	H 2000.500	25114	6640	35	4.2	44.7	-15.2	15.4	3.3	EN	Berdnikova, 2001
6	3590	29494	Galashikha	GAL_Grave05-2	20+ y.	U	H 2000.501	25115	6592	36	1.8	43.3	-14.6	15.4	3.3	EN	Berdnikova, 2001
7	3590	29495	Galashikha	GAL_Grave07	20+ y.	U	H 2000.502	25178	6573	36	1.5	49.0	-15.3	15.4	3.3	EN	Berdnikova, 2001
8	3590	29496	Galashikha	GAL_Grave16	20+ y.	U	H 2000.503	25149	6540	35	3.1	53.0	-15.9	14.7	3.3	EN	Berdnikova, 2001
9	3590	29497	Galashikha	GAL_Grave17-1	20+ y.	U	H 2000.504	25150	6655	35	4.5	45.6	-14.9	14.9	3.3	EN	Berdnikova, 2001
10	3590	29498	Galashikha	GAL_Grave17-2	20+ y.	U	H 2000.505	25151	6685	36	7.3	45.7	-15.3	14.4	3.2	EN	Berdnikova, 2001
11	3590	29499	Galashikha	GAL_Grave18	20+ y.	U	H 2000.506	25152	6690	36	1.3	44.4	-16.3	15.2	3.3	EN	Berdnikova, 2001
12	4163	34447	Glzkovo	GLZ_1887.006	20+ y.	U	H 2013.007	28747	3684	29	12.9	42.3	-17.4	12.5	3.3	EBA	Okladnikov, 1955; 1974: 30
13	3920	32037	Gorodishche II	GO2_1995.002	35-45 y.	F	H 2012.024	26894	4543	31	13.6	43.0	-16.5	14.2	3.2	EBA	V.I. Bazaliskii pers. comm.
14	3920	32038	Gorodishche II	GO2_1996.003	35-45 y.	M	H 2012.025	26895	4556	32	16.1	43.1	-16.7	13.7	3.2	EBA	V.I. Bazaliskii pers. comm.
15	3920	32039	Gorodishche II	GO2_1996.004	35-40 y.	M	H 2012.027	26896	4445	31	15.2	43.1	-17.3	13.3	3.2	EBA	V.I. Bazaliskii pers. comm.
16	4163	34443	Isakovo	ISA_1932.002	36-55 y.	M	H 2013.003	28743	4913	31	12.9	46.6	-18.7	12.7	3.3	LN	Okladnikov, 1950; 1976: 118
17	3590	29501	Kaiskaya Gora	KGO_2006.001.01	20+ y.	U	H 2006.215	25155	7755	40	6.4	44.0	-17.7	12.6	3.2	LM	V.I. Bazaliskii pers. comm.
18	4163	34449	Kitoi	KIT_1880.004	20+ y.	M	H 2013.010	28749	6660	35	0.6	43.1	-15.7	14.2	3.3	EN	Okladnikov, 1950; 1974: 49
19	4163	34451	Kitoi	KIT_1880.011	20+ y.	M	H 2013.012	28751	6706	35	6.1	45.2	-16.1	14.8	3.4	EN	Okladnikov, 1950; 1974: 49
20	3590	29517	Kitoi	KIT_surface	20+ y.	U	H 1997.275	25129	6879	37	15.6	44.4	-14.7	15.3	3.2	EN	Okladnikov, 1950; 1974: 49
21	3590	30266	Lokomotiv	LOK_1980.002.02	35-39 y.	U	H 1992.009	25740	6838	36	12.2	45.7	-15.5	14.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
22	3590	30282	Lokomotiv	LOK_1980.002.03	25-35 y.	F	H 2001.308	25704	6829	34	11.8	44.5	-14.8	14.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
23	3590	30284	Lokomotiv	LOK_1980.006	20+ y.	M	H 2001.390	25706	6751	35	7.8	47.2	-15.1	15.2	3.4	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
24	3590	30276	Lokomotiv	LOK_1980.007	40-45 y.	F	H 2001.124	25700	6711	35	11.0	44.7	-15.3	14.6	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
25	3590	30267	Lokomotiv	LOK_1980.009	20+ y.	F	H 1992.014	25741	6573	34	2.8	44.3	-15.2	14.6	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
26	3590	30290	Lokomotiv	LOK_1980.022.02	20-25 y.	M	H 2003.672	25637	6800	40	8.2	44.8	-14.8	15.2	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
27	3828	31108	Lokomotiv	LOK_1980.022.02	20-25 y.	M	H 2003.672	26285	6808	37	15.2	46.3	-15.0	15.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
28	3590	30286	Lokomotiv	LOK_1980.022.03	20-25 y.	M	H 2002.154	25633	6875	40	9.2	45.8	-14.8	14.7	3.1	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
29	3828	31109	Lokomotiv	LOK_1980.022.03	20-25 y.	M	H 2002.154	26286	6878	38	16.9	43.8	-14.6	14.5	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
30	3590	30265	Lokomotiv	LOK_1981.023	20-25 y.	M	H 1991.046	25629	6695	40	10.0	42.9	-14.9	15.7	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
31	3828	31111	Lokomotiv	LOK_1981.024.01	12-15 y.	U	H 1992.040	26288	6793	36	13.9	43.6	-14.9	14.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
32	3590	30287	Lokomotiv	LOK_1981.024.04	8-10 y.	U	H 2002.162	25634	6775	40	11.1	46.0	-15.2	14.3	3.1	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
33	4164	34476	Lokomotiv	LOK_1981.024.05	45-50 y.	M	H 1992.044	28698	6580	36	11.0	43.5	-15.4	14.6	3.3	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
34	3590	30278	Lokomotiv	LOK_1981.025.01	35-40 y.	F	H 2001.173	25701	6748	35	5.1	44.0	-14.6	14.4	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
35	3590	30281	Lokomotiv	LOK_1981.025.02	20-22 y.	F	H 2001.288	25703	6678	35	4.7	47.1	-14.7	15.2	3.3	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
36	3590	30268	Lokomotiv	LOK_1981.025.03	25-35 y.	F?	H 1992.048	25692	6779	34	5.7	45.6	-14.9	15.2	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
37	3590	30288	Lokomotiv	LOK_1981.025.05	35-50 y.	M	H 2003.507	25635	6775	45	10.0	46.0	-15.3	14.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
38	3590	30270	Lokomotiv	LOK_1984.029	30-40 y.	F?	H 1992.053	25694	6894	36	6.0	46.0	-15.0	14.8	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
39	3590	30271	Lokomotiv	LOK_1985.030.01	35-40 y.	M	H 1992.054	25695	6570	34	5.3	43.9	-15.9	13.9	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
40	3590	30272	Lokomotiv	LOK_1985.033	35-40 y.	M	H 1992.058	25696	6827	34	5.2	44.6	-15.3	14.6	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
41	3590	30273	Lokomotiv	LOK_1985.034	35-40 y.	F	H 1992.059	25697	6748	36	6.4	44.8	-15.1	14.7	3.3	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
42	3590	30277	Lokomotiv	LOK_1985.035	20+ y.	U	H 2001.166	25630	6615	40	2.7	43.2	-14.8	15.7	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
43	3828	31115	Lokomotiv	LOK_1988.038.01	50+ y.	F	H 1992.063	26292	6882	37	14.6	44.4	-14.5	15.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
44	3828	31116	Lokomotiv	LOK_1988.038.02	35-45 y.	F	H 1992.064	26293	6836	38	10.2	44.8	-15.9	14.7	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
45	3590	30283	Lokomotiv	LOK_1988.039	20-25 y.	F	H 2001.379	25705	6713	35	15.2	48.9	-15.5	14.8	3.4	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
46	3590	30274	Lokomotiv	LOK_1990.041.02	5-7 y.	U	H 1992.068	25698	6908	35	17.9	46.3	-15.6	14.0	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
47	3590	30280	Lokomotiv	LOK_1990.042	40-50 y.	M	H 2001.260	25631	6865	40	4.2	44.4	-15.4	14.2	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
48	3590	30280	Lokomotiv	LOK_1990.042	40-50 y.	M	H 2001.260	25632	6880	40	4.5	43.9	-15.4	14.1	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
49	3590	30275	Lokomotiv	LOK_1990.043.02	40-44 y.	F	H 1992.071	25699	6905	35	11.1	45.9	-15.1	13.9	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
50	3590	30279	Lokomotiv	LOK_1990.044.01	35-39 y.	M	H 2001.254	25702	6929	35	9.9	45.6	-15.0	14.5	3.3	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
51	3590	30293	Lokomotiv-Raisovet	LOR_1980.001	30-34 y.	M	H 2001.267	25640	6800	40	6.6	43.6	-15.0	14.9	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
52	3828	31118	Lokomotiv-Raisovet	LOR_1980.003.01	30-45 y.	M	H 2001.130	26295	6808	37	14.2	42.9	-15.5	14.2	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
53	3590	30291	Lokomotiv-Raisovet	LOR_1991.007.01	50+ y.	M	H 1992.006	25638	6980	50	6.0	47.7	-14.9	14.4	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
54	3590	30294	Lokomotiv-Raisovet	LOR_1997.011	20-25 y.	F	H 2001.283	25641	6835	40	4.0	43.9	-14.4	15.3	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
55	3828	31120	Lokomotiv-Raisovet	LOR_1997.011	20-25 y.	F	H 2001.283	26297	7009	39	7.5	43.0	-14.4	15.4	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
56	3590	30295	Lokomotiv-Raisovet	LOR_1998.013.01	6-8 y.	U	H 2001.300	25642	6770	40	9.2	44.3	-15.1	14.2	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
57	3590	30292	Lokomotiv-Raisovet	LOR_1998.014	30-39 y.	M	H 2001.120	25639	6915	40	2.7	44.9	-14.7	14.8	3.2	EN	Bazaliskii and Savelyev, 2003; Okladnikov, 1974: 34
58	4163	34442	Pad' Khinskaya	PKH_1936.001	20+ y.	U	H 2013.001	28742	7381	37	15.4	40.0	-16.8	13.6	3.2	LM	Okladnikov, 1950; 1975: 78
59	3092	23993															

96	3590	29505	Khotoruk	KHO_1978.007	20+ y.	U	H 2000.186	25118	7657	39	10.7	44.1	-18.5	11.9	3.2	LM or EN	Konopatskii, 1982
97	3920	32049	Khuzhir-Nuge XIV	K14_1998.036.01	35-50 y.	U	H 1998.318	26907	3800	30	4.8	42.2	-18.9	12.4	3.2	EBA	Weber et al., 2008
98	3920	32050	Khuzhir-Nuge XIV	K14_1998.037.01	15-20 y.	M?	H 1998.320	26908	3803	31	2.4	40.9	-19.0	11.1	3.2	EBA	Weber et al., 2008
99	3920	32051	Khuzhir-Nuge XIV	K14_1998.037.02	15-20 y.	M?	H 1998.393	26909	3688	30	3.7	41.5	-19.2	11.7	3.2	EBA	Weber et al., 2008
100	3920	32051	Khuzhir-Nuge XIV	K14_1998.037.02	15-20 y.	M?	H 1998.393	27554	3768	31	3.7	42.0	-19.1	11.7	3.2	EBA	Weber et al., 2008
101	3920	32056	Khuzhir-Nuge XIV	K14_1999.045	7.5-11.5 y.	M?	H 2003.623	26912	3829	29	4.3	43.4	-17.9	14.4	3.2	EBA	Weber et al., 2008
102	3920	32053	Khuzhir-Nuge XIV	K14_1999.049	50+ y.	U	H 1999.184	26981	3888	30	7.8	45.0	-17.6	15.8	3.2	EBA	Weber et al., 2008
103	4164	34477	Khuzhir-Nuge XIV	K14_1999.057.02	35-50 y.	M	H 2001.646	28699	3969	29	11.9	43.6	-16.6	16.6	3.3	EBA	Weber et al., 2008
104	3920	32054	Khuzhir-Nuge XIV	K14_2000.077	11.5-15 y.	M?	H 2000.169	26910	3778	29	3.4	42.6	-18.7	10.4	3.2	EBA	Weber et al., 2008
105	3920	32054	Khuzhir-Nuge XIV	K14_2000.077	11.5-15 y.	M?	H 2000.169	27619	3802	30	3.4	41.0	-18.6	10.6	3.2	EBA	Weber et al., 2008
106	3920	32055	Khuzhir-Nuge XIV	K14_2001.087	35-50 y.	M	H 2001.616	26911	3833	30	5.1	43.1	-18.4	12.8	3.2	EBA	Weber et al., 2008
107	3590	29518	Kulgana	KUL_1977.000	20+ y.	U	H 1991.035	25130	4230	31	10.8	43.6	-19.2	13.7	3.3	EBA	Konopatskii, 1982
108	3590	29519	Kurma XI	KUR_2002.001	20-35 y.	M	H 2002.110	25131	3954	31	12.1	43.6	-19.1	11.7	3.2	EBA	Weber et al., 2012
109	3201	25375	Kurma XI	KUR_2002.003	20-35 y.	U	H 2002.129	21956	4207	33	3.2	43	-17.9	15.5	3.2	EBA	Weber et al., 2012
110	3590	29520	Kurma XI	KUR_2002.004	36-55 y.	M	H 2002.117	25132	4120	30	13.5	44.9	-18.4	15.7	3.2	EBA	Weber et al., 2012
111	3590	29520	Kurma XI	KUR_2002.004	36-55 y.	M	H 2002.117	25133	4143	30	14.0	44.0	-18.4	15.6	3.2	EBA	Weber et al., 2012
112	3920	32062	Kurma XI	KUR_2002.005	20-35 y.	U	H 2002.141	26922	4204	31	12.8	43.9	-18.2	15.2	3.1	EBA	Weber et al., 2012
113	3920	32065	Kurma XI	KUR_2002.006	20-35 y.	F	H 2002.113	26920	4157	32	15.2	44.3	-18.6	14.7	3.1	EBA	Weber et al., 2012
114	3201	25372	Kurma XI	KUR_2002.007.01	20-55 y.	U	H 2002.090	21953	4181	36	6	45.3	-18.0	14.7	3.3	EBA	Weber et al., 2012
115	3201	25373	Kurma XI	KUR_2002.007.02	20-55 y.	U	H 2002.103	21954	4240	34	12.5	43.3	-18.5	15.2	3.2	EBA	Weber et al., 2012
116	3590	29521	Kurma XI	KUR_2002.009	20-55 y.	U	H 2002.135	25134	4538	29	8.8	44.8	-19.0	14.7	3.1	EBA	Weber et al., 2012
117	3590	29521	Kurma XI	KUR_2002.009	20-55 y.	U	H 2002.135	25135	4490	30	5.3	43.2	-18.9	14.6	3.1	EBA	Weber et al., 2012
118	4067	33387	Kurma XI	KUR_2002.010	20-35 y.	M	H 2002.101	27842	4300	26	7.9	42.6	-17.5	17.0	3.2	EBA	Weber et al., 2012
119	3201	25374	Kurma XI	KUR_2002.012	20-55 y.	U	H 2002.126	21955	3979	33	11.8	42.6	-19.3	11.4	3.2	EBA	Weber et al., 2012
120	3920	32066	Kurma XI	KUR_2002.013	36-55 y.	U	H 2002.122	26921	4189	31	8.9	43.8	-18.7	14.0	3.1	EBA	Weber et al., 2012
121	4067	33388	Kurma XI	KUR_2002.014	20-35 y.	F	H 2002.096	27843	4158	28	7.8	43.4	-18.9	13.6	3.3	EBA	Weber et al., 2012
122	3590	29522	Kurma XI	KUR_2002.015	14-19 y.	M	H 2002.151	25136	4078	30	11.1	43.9	-19.5	12.8	3.1	EBA	Weber et al., 2012
123	4067	33389	Kurma XI	KUR_2002.016	14-35 y.	F	H 2002.145	27844	4169	27	11.4	43.2	-19.0	15.0	3.3	EBA	Weber et al., 2012
124	4067	33390	Kurma XI	KUR_2003.017	20+ y.	M?	H 2003.016	27845	4289	25	5.1	43.5	-18.2	16.2	3.3	EBA	Weber et al., 2012
125	4164	34472	Kurma XI	KUR_2003.018	17-19 y.	F?	H 2003.005	28773	4233	31	16.3	43.0	-18.7	14.1	3.2	EBA	Weber et al., 2012
126	4067	33391	Kurma XI	KUR_2003.019	20-30 y.	M?	H 2003.012	27846	4121	25	2.9	43.2	-19.4	13.2	3.4	EBA	Weber et al., 2012
127	3590	29523	Kurma XI	KUR_2003.022	50+ y.	F?	H 2003.026	25137	7019	36	3.9	42.5	-18.4	12.1	3.2	LM or EN	Weber et al., 2012
128	3590	29524	Kurma XI	KUR_2003.024	20-35 y.	F?	H 2003.032	25138	7474	37	4.5	44.5	-16.7	15.5	3.1	LM or EN	Weber et al., 2012
129	3590	29525	Kurma XI	KUR_2003.025	20+ y.	U	H 2003.040	25139	4414	30	14.9	43.8	-18.2	15.9	3.1	EBA	Weber et al., 2012
130	4067	33393	Kurma XI	KUR_2003.026	35-50 y.	M?	H 2003.036	27847	4283	27	3.7	43.0	-17.7	15.4	3.1	EBA	Weber et al., 2012
131	3590	30114	Sarminskii Mys	SMS_1986.009	20+ y.	M?	H 1997.001	25564	4732	32	8.9	42.8	-17.2	16.3	3.2	EBA	Goriunova, 2002
132	3590	30113	Sarminskii Mys	SMS_1986.011.01	8-13 y.	U	H 1994.008	25563	4736	33	3.7	46.3	-17.2	16.3	3.3	LN	Goriunova, 1997
133	3590	30120	Sarminskii Mys	SMS_1986.011.04	20-35 y.	M?	H 2000.512	25488	4747	29	8.1	43.9	-17.0	16.6	3.2	LN	Goriunova, 1997
134	3590	30115	Sarminskii Mys	SMS_1986.012	20+ y.	U	H 1997.002	25565	4092	30	7.6	41.2	-17.5	15.0	3.2	EBA	Goriunova, 2002
135	3590	30121	Sarminskii Mys	SMS_1986.013	20+ y.	U	H 2000.514	25658	4221	31	13.7	43.0	-18.7	15.4	3.2	EBA	Goriunova, 2002
136	3590	30122	Sarminskii Mys	SMS_1986.017	20-35 y.	M	H 2000.515	25566	4680	32	12.7	46.7	-17.4	14.8	3.2	LN	Goriunova, 1997
137	3590	30123	Sarminskii Mys	SMS_1986.019.01	14-19 y.	M	H 2000.516	25567	4846	33	2.9	35.0	-17.7	15.2	3.3	LN	Goriunova, 1997
138	3590	30124	Sarminskii Mys	SMS_1986.019.02	56+ y.	M	H 2000.517	25568	4751	32	6.7	44.7	-18.4	15.6	3.3	LN	Goriunova, 1997
139	3590	30125	Sarminskii Mys	SMS_1986.019.05	36-55 y.	F	H 2000.518	25569	4781	33	7.2	43.6	-16.9	15.2	3.2	LN	Goriunova, 1997
140	3590	30116	Sarminskii Mys	SMS_1987.021	20-35 y.	F	H 1997.004	25484	3813	27	13.0	42.9	-19.1	12.1	3.2	EBA	Goriunova, 2002
141	3590	30126	Sarminskii Mys	SMS_1987.022	20-35 y.	F?	H 2000.520	25570	7078	38	2.8	44.0	-17.9	12.8	3.3	LM or EN	Goriunova, 1997
142	3590	30127	Sarminskii Mys	SMS_1987.029.00	8-13 y.	U	H 2000.521	25571	4871	31	11.6	42.6	-17.1	16.0	3.2	LN	Goriunova, 1997
143	3590	30118	Sarminskii Mys	SMS_1987.033	36-55 y.	F	H 1997.006	25486	4065	27	8.2	43.5	-18.3	13.8	3.2	EBA	Goriunova, 2002
144	3590	29508	Shamanski Mys	SHM_1972.001.01	20-55 y.	F?	H 1991.023	25121	4045	31	16.9	47.3	-18.8	15.1	3.2	EBA	Konopatskii, 1982
145	3590	29510	Shamanski Mys	SHM_1972.002	36-55 y.	M	H 1993.003	25123	4079	31	18.2	47.1	-19.0	14.4	3.2	EBA	Konopatskii, 1982
146	3590	29512	Shamanski Mys	SHM_1972.002	36-55 y.	M	H 1993.005	25125	4060	31	15.1	46.4	-18.8	15.0	3.2	EBA	Konopatskii, 1982
147	3590	29514	Shamanski Mys	SHM_1973.001	20-55 y.	M	H 1993.007	25126	4153	32	4.5	45.5	-18.1	15.4	3.2	EBA	Konopatskii, 1982
148	3590	29509	Shamanski Mys	SHM_1973.002	20-55 y.	F	H 1993.002	25122	4150	30	13.5	46.2	-18.7	15.5	3.3	EBA	Konopatskii, 1982
149	3590	29513	Shamanski Mys	SHM_1973.003.01	20+ y.	F?	H 1993.006	24827	4010	30	9.5	44.5	-18.6	16.1	3.2	EBA	Konopatskii, 1982
150	3590	29507	Shamanski Mys	SHM_1973.004	20+ y.	U	H 1991.021	25120	4056	30	11.1	45.1	-18.4	15.7	3.2	EBA	Konopatskii, 1982
151	3590	29516	Shamanski Mys	SHM_1975.001	20-35 y.	M	H 2000.204	25128	4887	33	11.2	45.3	-17.3	17.5	3.2	EBA	Konopatskii, 1982
152	4163	34454	Shamanski Mys	SHM_1975.001	20-35 y.	M	H 1995.235	28754	4961	31	9.4	44.7	-17.3	17.6	3.3	EBA	Konopatskii, 1982
153	3590	29515	Shamanski Mys	SHM_1976.001.01	20+ y.	U	H 1993.008	25127	4902	33	4.0	45.8	-16.9	16.2	3.3	LN	Konopatskii, 1982
Southwest Baikal																	
154	3920	32081	Shamanka II	SHA_1998.004	35-45 y.	M	H 2012.031	27053	6906	38	11.6	44.2	-15.9	14.3	3.1	EN	Bazaliiskii, 2010
155	3920	32082	Shamanka II	SHA_1998.006	16-18 y.	M?	H 2012.037	27054	6483	37	12.8	44.0	-16.2	15.9	3.1	EN	Bazaliiskii, 2010
156	3092	23974	Shamanka II	SHA_1999.007	20-30 y.	F?	H 2002.205	20562	6329	33	10.3	42.2	-16.4	13.7	3.4	EN	Bazaliiskii, 2010
157	3920	32077	Shamanka II	SHA_2000.009	17-18 y.	M?	H 2002.169	27032	3871	29	11.9	43.6	-15.8	13.4	3.2	EBA	Turkin and Kharinskii, 2004
158	3920	32077	Shamanka II	SHA_2000.009	17-18 y.	M?	H 2002.169	27033	3900	29	11.7	43.8	-15.9	13.5	3.2	EBA	Turkin and Kharinskii, 2004
159	4067	33396	Shamanka II	SHA_2001.016	20-35 y.	U	H 2002.191	28037	6842	35	7.6	41.6	-15.7	15.7	3.0	EN	Bazaliiskii, 2010
160	4164	34474	Shamanka II	SHA_2001.016	20-35 y.	U	H 2002.191	28696	6811	34	18.3	43.5	-15.8	15.0	3.3	EN	Bazaliiskii, 2010
161	3590	29046	Shamanka II	SHA_2002.021.02	25-30 y.	M	H 2002.243	24741	6972	34	17.3	45.4	-16.5	14.1	3.1	EN	Bazaliiskii, 2010
162	3590	29045	Shamanka II	SHA_2002.022	19-22 y.	M	H 2002.234	24740	7105	35	16.2	45.3	-15.9	15.6	3.2	EN	Bazaliiskii, 2010
163	3590	29068	Shamanka II	SHA_2002.022	19-22 y.	M	H 2009.133	24797	7059	37	14.6	44.3	-16.0	15.7	3.2	EN	Bazaliiskii, 2010
164	3590	29044	Shamanka II	SHA_2002.023.05	20+ y.	U	H 2002.223	24739	7021	35	15.2	47.4	-15.9	14.6	3.1	EN	Bazaliiskii, 2010
165	3590	29056	Shamanka II	SHA_2002.024.02	12-15 y.	U	H 2003.657	24772	6901	34	15.0	43.8					

196	3590	29064	Shamanka II	SHA_2004.049.01	17-20 y.	M?	H 2007.143	24793	6319	33	13.8	45.2	-16.3	13.5	3.2	EN	Bazaliiskii, 2010
197	3612	29312	Shamanka II	SHA_2004.049.01	17-20 y.	M?	H 2004.052	26270	6378	37	16.1	46.3	-16.1	13.5	3.2	EN	Bazaliiskii, 2010
198	3201	25357	Shamanka II	SHA_2004.050.01	25-35 y.	M	H 2007.146	21491	6392	34	19.8	42.1	-16.5	14.1	3.1	EN	Bazaliiskii, 2010
199	3590	29065	Shamanka II	SHA_2004.050.01	25-35 y.	M	H 2007.146	24794	6418	35	15.9	45.3	-16.6	14.8	3.2	EN	Bazaliiskii, 2010
200	3201	25358	Shamanka II	SHA_2004.050.02	25-29 y.	M	H 2007.148	21492	6851	35	21.0	41.8	-16.9	13.7	3.1	EN	Bazaliiskii, 2010
201	3590	29066	Shamanka II	SHA_2004.050.02	25-29 y.	M	H 2007.148	24795	6902	37	13.6	45.5	-16.8	13.7	3.2	EN	Bazaliiskii, 2010
202	3201	25359	Shamanka II	SHA_2004.050.03	30-40 y.	M	H 2007.150	21493	6852	35	19.5	43.1	-15.9	14.9	3.1	EN	Bazaliiskii, 2010
203	3590	29067	Shamanka II	SHA_2004.050.03	30-40 y.	M	H 2007.150	24796	6975	37	13.7	44.8	-15.8	14.7	3.2	EN	Bazaliiskii, 2010
204	3201	25315	Shamanka II	SHA_2004.051	20-25 y.	M	H 2004.059	21526	6856	40	9.1	44.5	-16.6	15.1	2.9	EN	Bazaliiskii, 2010
205	3612	29313	Shamanka II	SHA_2004.052.01	20-24 y.	M?	H 2004.131	26271	6845	40	16.5	47.4	-14.7	15.3	3.2	EN	Bazaliiskii, 2010
206	3612	29314	Shamanka II	SHA_2004.052.02	25-29 y.	M	H 2004.132	26441	6892	37	15.7	44.2	-15.4	15.5	3.2	EN	Bazaliiskii, 2010
207	3201	25316	Shamanka II	SHA_2004.053.01	20-25 y.	M	H 2004.064	21527	6928	37	13.8	43.1	-16.2	15.7	3.0	EN	Bazaliiskii, 2010
208	3201	25317	Shamanka II	SHA_2004.053.02	50+ y.	M	H 2004.070	21528	7001	38	12.3	43	-16.0	15.8	3.0	EN	Bazaliiskii, 2010
209	3612	29315	Shamanka II	SHA_2004.054.01	17-21 y.	F	H 2004.073	26442	6939	38	14.7	44.7	-15.2	15.2	3.2	EN	Bazaliiskii, 2010
210	3612	29316	Shamanka II	SHA_2004.055.01	35-39 y.	M	H 2004.095	26443	6881	38	15.6	45.1	-15.9	14.6	3.2	EN	Bazaliiskii, 2010
211	3612	29317	Shamanka II	SHA_2004.055.02	5-7 y.	U	H 2004.101	26444	7017	39	16.6	43.6	-16.0	15.4	3.2	EN	Bazaliiskii, 2010
212	3612	29319	Shamanka II	SHA_2004.056.02	8-10 y.	U	H 2004.082	26446	7036	38	18.9	42.5	-15.7	15.5	3.2	EN	Bazaliiskii, 2010
213	3920	32080	Shamanka II	SHA_2004.056.02	8-10 y.	U	H 2004.082	27052	6935	38	12.6	43.2	-15.7	15.4	3.1	EN	Bazaliiskii, 2010
214	3201	25318	Shamanka II	SHA_2004.057.00	25-35 y.	F	H 2004.123	21943	7060	50	17.9	43.9	-15.3	15.3	3.2	EN	Bazaliiskii, 2010
215	3612	29320	Shamanka II	SHA_2004.058.01	35-45 y.	M	H 2004.085	26447	6957	39	16.4	42.2	-16.8	13.9	3.2	EN	Bazaliiskii, 2010
216	3612	29320	Shamanka II	SHA_2004.058.01	35-45 y.	M	H 2004.085	26448	7002	38	18.0	42.3	-16.9	13.8	3.2	EN	Bazaliiskii, 2010
217	3201	25323	Shamanka II	SHA_2005.059.01	35-39 y.	M	H 2005.023	21533	6450	38	15.2	59.8	-15.9	16.0	3.2	EN	Bazaliiskii, 2010
218	3201	25331	Shamanka II	SHA_2005.059.02	15-19 y.	F?	H 2005.057	21540	6694	39	11.5	45.1	-17.7	14.2	3.2	EN	Bazaliiskii, 2010
219	3201	25324	Shamanka II	SHA_2005.060.01	50+ y.	M	H 2005.032	21534	6819	38	8.4	58.1	-16.6	16.0	3.3	EN	Bazaliiskii, 2010
220	3201	25328	Shamanka II	SHA_2005.060.02	40-44 y.	F	H 2005.040	21538	6959	39	13.4	42.6	-15.9	15.1	3.2	EN	Bazaliiskii, 2010
221	3201	25330	Shamanka II	SHA_2005.061.01	25-29 y.	F	H 2005.043	21539	6881	40	13.8	41	-15.0	14.9	3.2	EN	Bazaliiskii, 2010
222	3201	25322	Shamanka II	SHA_2005.061.02	35-45 y.	M	H 2005.020	21944	6915	38	15.9	42.1	-15.9	14.3	3.2	EN	Bazaliiskii, 2010
223	3612	29321	Shamanka II	SHA_2005.062.01	35-45 y.	F?	H 2005.011	26449	6862	37	17.4	44.5	-16.0	13.9	3.2	EN	Bazaliiskii, 2010
224	3612	29322	Shamanka II	SHA_2005.062.02	35-45 y.	M	H 2005.033	26450	6895	37	19.1	42.6	-15.8	15.1	3.2	EN	Bazaliiskii, 2010
225	3612	29323	Shamanka II	SHA_2005.062.03	20+ y.	F?	H 2005.074	26451	7022	39	17.9	43.2	-15.8	14.6	3.2	EN	Bazaliiskii, 2010
226	3612	29324	Shamanka II	SHA_2005.062.04	20+ y.	M?	H 2005.002	26452	7005	38	18.9	42.7	-15.7	14.9	3.2	EN	Bazaliiskii, 2010
227	3201	25327	Shamanka II	SHA_2005.063.01	25-29 y.	M	H 2005.039	21537	6815	38	10.4	42.6	-15.5	15.4	3.3	EN	Bazaliiskii, 2010
228	3201	25360	Shamanka II	SHA_2005.063.02	25-35 y.	M	H 2007.164	21494	6908	32	17.1	42.7	-15.0	14.5	3.1	EN	Bazaliiskii, 2010
229	3201	25326	Shamanka II	SHA_2005.064.01	30-39 y.	M	H 2005.037	21536	6381	37	15.8	42	-16.5	14.9	3.2	EN	Bazaliiskii, 2010
230	3201	25320	Shamanka II	SHA_2005.065.01	50+ y.	M	H 2005.005	21530	6945	45	13	44	-16.6	14.4	3.2	EN	Bazaliiskii, 2010
231	3201	25325	Shamanka II	SHA_2005.066.01	25-35 y.	F	H 2005.034	21535	7005	40	13.4	59.9	-17.1	13.6	3.2	EN	Bazaliiskii, 2010
232	3201	25325	Shamanka II	SHA_2005.066.01	25-35 y.	F	H 2005.034	21945	6931	39	13.4	45.2	-17.1	13.6	3.2	EN	Bazaliiskii, 2010
233	3201	25321	Shamanka II	SHA_2005.067	7-9 y.	U	H 2005.008	21532	6885	40	12.8	43.9	-17.6	14.1	3.2	EN	Bazaliiskii, 2010
234	3612	29325	Shamanka II	SHA_2005.068	45-49 y.	M	H 2005.031	26453	6889	37	17.6	43.1	-16.0	15.2	3.2	EN	Bazaliiskii, 2010
235	3612	29326	Shamanka II	SHA_2006.069.01	25-30 y.	F	H 2006.052	26454	6899	35	7.6	45.2	-15.8	14.8	3.1	EN	Bazaliiskii, 2010
236	3201	25337	Shamanka II	SHA_2006.069.02	20-25 y.	F	H 2006.018	21546	6953	39	8.4	44.3	-14.7	14.8	3.2	EN	Bazaliiskii, 2010
237	3201	25342	Shamanka II	SHA_2006.070	40-50 y.	M	H 2006.057	21950	6819	37	10.8	43.7	-15.8	14.6	3.3	EN	Bazaliiskii, 2010
238	3201	25340	Shamanka II	SHA_2006.071	35-45 y.	M	H 2006.042	21947	6860	37	14.3	45.5	-15.8	14.6	3.2	EN	Bazaliiskii, 2010
239	3201	25340	Shamanka II	SHA_2006.071	35-45 y.	M	H 2006.042	21948	6814	39	12.0	45.5	-16.7	14.8	3.1	EN	Bazaliiskii, 2010
240	3201	25341	Shamanka II	SHA_2006.073	16-18 y.	F	H 2006.047	21949	7010	45	13.2	47.3	-16.5	14.1	3.3	EN	Bazaliiskii, 2010
241	3201	25339	Shamanka II	SHA_2006.074	18-20 y.	M	H 2006.028	21548	6948	39	14	45.3	-16.0	14.5	3.3	EN	Bazaliiskii, 2010
242	3612	29327	Shamanka II	SHA_2006.075	25-29 y.	M	H 2006.037	26455	7093	37	12.4	46.7	-16.4	16.3	3.2	EN	Bazaliiskii, 2010
243	3612	29328	Shamanka II	SHA_2006.076	40-50 y.	M	H 2006.033	26456	7123	37	7.2	45.1	-16.4	15.1	3.2	EN	Bazaliiskii, 2010
244	3201	25344	Shamanka II	SHA_2006.077	30-39 y.	F	H 2006.062	21549	7025	40	15	43.2	-16.7	14.7	3.2	EN	Bazaliiskii, 2010
245	3201	25343	Shamanka II	SHA_2006.079	35-50 y.	F?	H 2006.060	21951	7063	39	10.3	43.2	-15.2	15.0	3.2	EN	Bazaliiskii, 2010
246	3201	25345	Shamanka II	SHA_2006.083.01	20-22 y.	M	H 2006.066	21550	6620	40	12.6	42.5	-17.0	14.1	3.2	EN	Bazaliiskii, 2010
247	3612	29329	Shamanka II	SHA_2006.083.02	20-30 y.	F?	H 2006.067	26457	7095	36	8.8	45.7	-16.6	16.6	3.1	EN	Bazaliiskii, 2010
248	3201	25346	Shamanka II	SHA_2007.085	25-35 y.	M	H 2007.006	21551	6935	39	9.5	42.8	-15.6	13.7	3.3	EN	Bazaliiskii, 2010
249	3201	25347	Shamanka II	SHA_2007.086.01	18-20 y.	M	H 2007.008	21552	6584	39	12.9	41.4	-16.5	14.1	3.3	EN	Bazaliiskii, 2010
250	3612	29330	Shamanka II	SHA_2007.086.02	20+ y.	U	H 2007.047	26458	6815	35	6.6	43.4	-17.0	15.6	3.1	EN	Bazaliiskii, 2010
251	3201	25355	Shamanka II	SHA_2007.088	6-8 y.	U	H 2007.040	21489	6910	35	18.3	44.5	-17.0	13.7	3.1	EN	Bazaliiskii, 2010
252	3201	25349	Shamanka II	SHA_2007.090	18-20 y.	M	H 2007.015	21554	7000	40	10.2	42.4	-15.6	15.5	3.2	EN	Bazaliiskii, 2010
253	3201	25353	Shamanka II	SHA_2007.092	10-12 y.	U	H 2007.032	21487	6867	35	15.1	43.5	-16.2	13.9	3.1	EN	Bazaliiskii, 2010
254	3201	25356	Shamanka II	SHA_2007.093.02	35-40 y.	F	H 2007.045	21490	7012	37	17	43.7	-17.0	14.5	3.1	EN	Bazaliiskii, 2010
255	3201	25348	Shamanka II	SHA_2007.096.02	30-35 y.	F	H 2007.013	21553	6690	40	7.1	43.1	-16.5	14.2	3.2	EN	Bazaliiskii, 2010
256	3201	25348	Shamanka II	SHA_2007.096.02	30-35 y.	F	H 2007.013	27392	6679	34	14.9	44.1	-15.7	14.3	3.2	EN	Bazaliiskii, 2010
257	3201	25361	Shamanka II	SHA_2008.103.01	14-16 y.	U	H 2008.002	21495	3650	28	17.9	44.6	-16.6	12.4	3.1	EN	V.I. Bazaliiskii pers. comm.
258	3201	25362	Shamanka II	SHA_2008.103.02	5-6 y.	U	H 2008.008	21496	3746	28	19.9	44.5	-16.6	12.4	3.1	EN	V.I. Bazaliiskii pers. comm.
259	3201	25363	Shamanka II	SHA_2008.104	25-35 y.	F	H 2008.011	21497	6266	32	18.2	43.7	-16.6	13.7	3.1	EN	Bazaliiskii, 2010
260	3201	25363	Shamanka II	SHA_2008.104	25-35 y.	F	H 2008.011	27552	6379	39	18.2	43.3	-16.3	13.8	3.2	EN	Bazaliiskii, 2010
261	4164	34475	Shamanka II	SHA_2008.104	25-35 y.	F	H 2008.010	28697	6372	33	13.7	45.3	-16.2	13.5	3.2	EN	Bazaliiskii, 2010
262	3201	25364	Shamanka II	SHA_2008.106	40-50 y.	F	H 2008.020	21498	2633	27	20.9	43.2	-17.7	11.5	3.1	LBA	V.I. Bazaliiskii pers. comm.
263	3201	25365	Shamanka II	SHA_2008.107	20-23 y.	M	H 2008.027	21499	3764	28	18.9	42.9	-16.2	12.9	3.1	EBA	V.I. Bazaliiskii pers. comm.
264	3201	25365	Shamanka II	SHA_2008.107	20-23 y.	M	H 2008.027	21500	3764	28	18.7	43.0	-16.2	13.0	3.1	EBA	V.I. Bazaliiskii pers. comm.
265	3201	25366	Shamanka II														

296	3590	29759	Obkhoi	OBK_1971.003.01	20+ y.	U	H	1991.006	25231	4070	31	15.4	44.7	-19.4	10.4	3.2	EBA	Okladnikov, 1971
297	3590	29757	Obkhoi	OBK_1971.003.02	Subadult	U	H	1991.004	25229	3950	30	15.8	45.1	-18.4	9.6	3.2	EBA	Okladnikov, 1971
298	3590	29761	Obkhoi	OBK_1971.004.01	20+ y.	U	H	1991.009	25262	4089	29	18.0	43.5	-19.4	10.8	3.2	EBA	Okladnikov, 1971
299	3590	29762	Obkhoi	OBK_1971.004.02	Subadult	U	H	1991.010	25263	4000	29	19.8	39.1	-19.1	10.9	3.2	EBA	Okladnikov, 1971
300	3590	29767	Obkhoi	OBK_1971.005	20+ y.	U	H	1993.010	25268	3888	31	14.1	45.2	-19.4	10.2	3.2	EBA	Okladnikov, 1971
301	3590	29763	Obkhoi	OBK_1971.007	20+ y.	U	H	1991.015	25264	4073	30	14.6	42.2	-19.0	10.8	3.2	EBA	Okladnikov, 1971
302	3590	29769	Obkhoi	OBK_1971.010	20+ y.	U	H	1993.013	25270	3922	28	1.7	43.8	-19.7	11.4	3.2	EBA	Okladnikov, 1971
303	3590	29770	Obkhoi	OBK_1971.013	20+ y.	U	H	1993.014	25307	4352	31	15.7	46.6	-19.4	11.3	3.3	EBA	Okladnikov, 1971
304	3590	29764	Obkhoi	OBK_1971.014.01	20+ y.	U	H	1991.029	25265	3977	30	16.3	48.3	-19.2	10.3	3.2	EBA	Okladnikov, 1971
305	3590	29765	Obkhoi	OBK_1971.014.02	20+ y.	U	H	1991.030	25266	3929	29	14.5	47.4	-19.0	10.1	3.2	EBA	Okladnikov, 1971
306	3590	29758	Obkhoi	OBK_1976.003	Subadult	U	H	1991.005	25230	4391	32	17.1	44.8	-19.3	10.3	3.2	EBA	Okladnikov, 1971
307	3934	32202	Popovskii Lug 2	POP2_2010.001	20+ y.	U	H	2011.001	27119	8070	45	14.9	41.3	-19.8	12.4	3.2	LM or EN	Zubkov, 2000: 15
308	3590	30131	Turuka	TUR_1992.002	20+ y.	U	H	1993.073	25574	6983	38	4.0	43.9	-20.3	12.7	3.2	EN	Bazaliiskii and Ineshin, 1995
309	3590	30129	Turuka	TUR_1992.004	20+ y.	U	H	1992.128	25573	6980	40	1.9	43.3	-20.6	13.0	3.3	EN	Bazaliiskii and Ineshin, 1995
310	3590	30132	Turuka	TUR_1993.005	20+ y.	U	H	1993.074	25489	7136	35	5.8	43.0	-20.1	13.2	3.3	EN	Bazaliiskii and Ineshin, 1995
311	4163	34445	Ulus Khalskii	UKH_1930.000	20+ y.	U	H	2013.005	28745	3991	30	17.1	43.7	-19.4	12.6	3.3	EBA	Okladnikov, 1955: 14
312	4164	34466	Ust' lamnaia	UIA_1977.005	20+ y.	F	H	2013.026	28767	4137	30	10.6	44.8	-19.8	12.1	3.3	EBA	Zubkov, 1978: 30
313	3590	30141	Ust' lamnaia	UIA_surface	20+ y.	U	H	1997.273	25496	3957	29	17.4	46.1	-19.4	11.1	3.3	EBA	Zubkov, 1978: 30
314	3590	30143	Zakuta	ZAK_1993.001	20+ y.	U	H	1994.001	25498	5121	30	7.8	44.9	-19.4	11.9	3.2	LN	Bazaliiskii, 2012
315	3590	30144	Zakuta	ZAK_1994.002	20+ y.	U	H	1994.002	25499	5189	30	16.2	44.5	-19.6	12.1	3.2	LN	Bazaliiskii, 2012
316	3590	30145	Zakuta	ZAK_1994.003	20+ y.	U	H	1994.003	25575	5136	32	10.1	42.9	-20.1	12.2	3.2	LN	Bazaliiskii, 2012
317	3590	30146	Zakuta	ZAK_1994.005	20+ y.	U	H	1995.001	25576	4926	33	16.7	43.6	-20.0	12.4	3.2	LN	Bazaliiskii, 2012
318	4163	34444	Zapleskino	ZAP_0000.003	20+ y.	U	H	2013.004	28744	5138	31	13.9	44.7	-19.6	11.6	3.3	LN	Okladnikov, 1955: 14

Note: Records are grouped by micro-region and then sorted by "Site" and "Master ID".

Supplement 2. OxCal 4.2.4 input file for Bayesian analysis of middle Holocene culture history of Cis-Baikal, Siberia, using the default uniform distribution model. All dates are corrected for the freshwater reservoir effect and grouped by culture historical periods and then sorted by corrected ^{14}C date BP.

```
Options()
{
  kIterations=2000;
};
Plot()
{
  Sequence("LM, EN, LN & EBA Cis-Baikal")
  {
    Boundary("LM Start");
    Phase("LM n=10")
    {
      R_Date("KGO_2006.001.01", 7568, 76);
      R_Date("KHO_1978.007", 7533, 65);
      R_Date("KUR_2003.024", 7237, 64);
      R_Date("PKH_1936.001", 7060, 74);
      R_Date("SMS_1987.022", 6942, 64);
      R_Date("KUR_2003.022", 6887, 63);
      R_Date("KHO_1977.002.00", 6688, 63);
      R_Date("KHO_1978.004.02", 6669, 64);
      R_Date("KHO_1978.005.01", 6621, 64);
      R_Date("ESH_1987.001", 6599, 74);
      Span("LM dated events");
      Interval("duration LM");
    };
    Boundary("LM End/EN Start");
    Phase("EN n=133")
    {
      R_Date("SHA_2005.066.01", 6653, 70);
      R_Date("SHA_2006.073", 6631, 78);
      R_Date("SHA_2004.058.01", 6628, 70);
      R_Date("SHA_2003.027.01", 6616, 72);
      R_Date("SHA_2006.076", 6614, 74);
      R_Date("SHA_2003.034", 6609, 73);
      R_Date("SHA_2007.085", 6607, 75);
      R_Date("SHA_2004.043", 6603, 73);
    }
  }
}
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R_Date("SHA_2002.021.02", 6586, 73);
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R_Date("SHA_2007.092", 6518, 73);
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R_Date("SHA_2007.090", 6445, 76);
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R_Date("SHA_2004.047", 6432, 51);
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R_Date("LOK_1984.029", 6430, 74);
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R_Date("SHA_2004.046", 6411, 53);
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R_Date("SHA_2006.070", 6374, 74);
R_Date("SHA_2003.026.02", 6373, 73);
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R_Date("LOK_1981.024.04", 6367, 76);
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R_Date("GAL_Grave16", 6079, 73);
R_Date("GAL_Grave04(1978)", 6049, 73);
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R_Date("LOK_1985.035", 6041, 76);
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R_Date("SHA_2003.030", 5953, 72);
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R_Date("ROZ_2008.003", 5939, 74);
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R_Date("SHA_2003.035.01", 5877, 72);
R_Date("SHA_1998.006", 5875, 74);
R_Date("SHA_2005.059.01", 5835, 75);
Span("EN dated events");
Interval("duration EN");
};
Boundary("EN End/MN Start");
Phase("MN n=0")
{
  Interval("duration MN");
};
Boundary("MN End/LN Start");
Phase("LN n=22")
{
  R_Date("ISA_1932.002", 4715, 71);
  R_Date("UID_1989.025.03", 4710, 71);
  R_Date("UID_1988.018", 4710, 71);
  R_Date("UID_1991.038", 4670, 75);
  R_Date("UID_1987.008", 4666, 72);
  R_Date("UID_1991.041", 4663, 72);
  R_Date("UID_1989.020.02", 4655, 75);
  R_Date("UID_1994.052", 4644, 71);
  R_Date("UID_1994.054", 4617, 74);
  R_Date("UID_1989.021.02", 4597, 70);
  R_Date("UID_1987.005", 4596, 73);
  R_Date("UID_1989.020.01", 4584, 71);
  R_Date("UID_1989.026.05", 4578, 74);
  R_Date("SHM_1976.001.01", 4572, 61);
  R_Date("UID_1994.053.01", 4548, 71);
  R_Date("SMS_1986.019.05", 4546, 61);
  R_Date("SMS_1987.029.02", 4534, 60);
  R_Date("SMS_1986.019.01", 4507, 61);
  R_Date("SMS_1986.017", 4412, 61);
  R_Date("SMS_1986.011.01", 4363, 61);
  R_Date("SMS_1986.011.04", 4359, 59);
  R_Date("SMS_1986.019.02", 4283, 61);
Span("LN dated events");
Interval("duration LN");
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};  
Boundary("LN End/EBA Start");  
Phase("EBA n=91")  
{  
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  R_Date("UID_1991.042", 4248, 71);  
  R_Date("GO2_1996.003", 4221, 72);  
  R_Date("GO2_1996.004", 4171, 71);  
  R_Date("GO2_1995.002", 4145, 71);  
  R_Date("OBK_1976.003", 4138, 51);  
  R_Date("KUR_2002.009", 4076, 56);  
  R_Date("OBK_1971.013", 4021, 51);  
  R_Date("MAK_1992.018", 3986, 51);  
  R_Date("KUR_2003.025", 3938, 60);  
  R_Date("KUR_2003.026", 3930, 58);  
  R_Date("MAK_1992.019", 3917, 50);  
  R_Date("OBK_1971.003.02", 3911, 50);  
  R_Date("BAD_1920.000", 3898, 70);  
  R_Date("UBE_1957.002", 3893, 67);  
  R_Date("OBK_1971.001.02", 3892, 35);  
  R_Date("MAK_1992.013.00", 3892, 50);  
  R_Date("KUR_2003.018", 3869, 60);  
  R_Date("KHA_2010.011", 3868, 60);  
  R_Date("OBK_1971.001.03", 3856, 50);  
  R_Date("MKV_1973.001", 3853, 51);  
  R_Date("OBK_1971.007", 3852, 50);  
  R_Date("KHA_2010.015", 3849, 60);  
  R_Date("KUR_2002.007.01", 3845, 63);  
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  R_Date("KUR_2002.013", 3831, 60);  
  R_Date("KUR_2002.014", 3826, 59);  
  R_Date("OBK_1971.001.01", 3821, 44);  
  R_Date("KUR_2002.010", 3820, 58);  
  R_Date("KUR_2002.003", 3811, 61);  
  R_Date("KUR_2002.012", 3804, 61);  
  R_Date("KUR_2002.005", 3801, 60);  
  R_Date("OBK_1971.004.01", 3800, 50);  
  R_Date("UID_1991.039", 3798, 72);  
  R_Date("KUR_2002.007.02", 3797, 62);
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R_Date("SMS_1987.033", 3789, 58);
R_Date("KHA_2010.005", 3783, 60);
R_Date("K14_2000.077", 3776, 56);
R_Date("KUR_2002.001", 3773, 60);
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R_Date("KUR_2002.006", 3757, 61);
R_Date("SHM_1973.001", 3747, 61);
R_Date("KHA_2010.009", 3745, 60);
R_Date("OBK_1971.014.02", 3742, 50);
R_Date("KUR_2002.015", 3741, 60);
R_Date("SMS_1986.013", 3737, 60);
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R_Date("UIA_1977.005", 3691, 50);
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R_Date("SHM_1973.002", 3657, 60);
R_Date("UIA_surface", 3641, 50);
R_Date("K14_1999.057.02", 3639, 59);
R_Date("K14_2001.087", 3637, 60);
R_Date("SHM_1972.002", 3634, 43);
R_Date("UKH_1930.000", 3619, 50);
R_Date("KHA_2003.003", 3614, 56);
R_Date("OBK_1971.005", 3608, 51);
R_Date("MNZ_1974.001", 3595, 50);
R_Date("SMS_1987.021", 3594, 58);
R_Date("SHA_2000.009", 3593, 67);
R_Date("SHM_1972.001.01", 3582, 60);
R_Date("K14_1998.036.01", 3582, 60);
R_Date("SHA_2008.103.02", 3578, 70);
R_Date("SHM_1973.004", 3575, 60);
R_Date("KHA_2010.007", 3556, 60);
R_Date("K14_1999.045", 3540, 59);

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R_Date("BO1_1971.002", 3539, 50);
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R_Date("K14_1999.049", 3506, 60);
R_Date("BO1_1971.001", 3503, 50);
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R_Date("BO2_1971.003", 3475, 50);
R_Date("SHM_1973.003.01", 3474, 60);
R_Date("UID_1994.048", 3437, 71);
R_Date("SHA_2008.111", 3409, 72);
Span("EBA dated events");
Interval("duration EBA");
};
Boundary("EBA End");
};
};
```

Supplement 3. OxCal 4.2.4 input file for Bayesian analysis of middle Holocene culture history of Cis-Baikal, Siberia, using the trapezium distribution model. All dates are corrected for the freshwater reservoir effect and grouped by culture historical periods and then sorted by corrected ^{14}C date BP.

```
Options()
{
  kIterations=2000;
};
Plot()
{
  Sequence("LM, EN, LN & EBA Cis-Baikal")
  {
    Boundary("LM Start")
    {
      Start();
      Transition();
      End();
    };
    Phase("LM n=10")
    {
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      R_Date("KHO_1978.007", 7533, 65);
      R_Date("KUR_2003.024", 7237, 64);
      R_Date("PKH_1936.001", 7060, 74);
      R_Date("SMS_1987.022", 6942, 64);
      R_Date("KUR_2003.022", 6887, 63);
      R_Date("KHO_1977.002.00", 6688, 63);
      R_Date("KHO_1978.004.02", 6669, 64);
      R_Date("KHO_1978.005.01", 6621, 64);
      R_Date("ESH_1987.001", 6599, 74);
      Span("LM dated events");
      Interval("duration LM");
    };
    Boundary("LM End/EN Start")
    {
      Start();
      Transition();
      End();
    };
  };
};
```

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Phase("EN n=133")
{
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  R_Date("SHA_2006.073", 6631, 78);
  R_Date("SHA_2004.058.01", 6628, 70);
  R_Date("SHA_2003.027.01", 6616, 72);
  R_Date("SHA_2006.076", 6614, 74);
  R_Date("SHA_2003.034", 6609, 73);
  R_Date("SHA_2007.085", 6607, 75);
  R_Date("SHA_2004.043", 6603, 73);
  R_Date("SHA_2002.021.02", 6586, 73);
  R_Date("SHA_2007.088", 6583, 73);
  R_Date("SHA_2007.093.02", 6581, 74);
  R_Date("SHA_2005.062.03", 6580, 75);
  R_Date("SHA_2006.077", 6573, 76);
  R_Date("SHA_2002.023.05", 6573, 73);
  R_Date("SHA_2004.045", 6568, 74);
  R_Date("SHA_2004.041", 6567, 53);
  R_Date("SHA_2006.079", 6565, 75);
  R_Date("LOR_1991.007.01", 6559, 81);
  R_Date("LOK_1990.043.02", 6555, 73);
  R_Date("SHA_2004.050.02", 6539, 69);
  R_Date("LOK_1990.041.02", 6535, 73);
  R_Date("SHA_2004.044.02", 6533, 73);
  R_Date("SHA_2005.065", 6529, 78);
  R_Date("SHA_2004.057.00", 6528, 81);
  R_Date("UID_1993.043", 6526, 78);
  R_Date("SHA_2003.033", 6522, 73);
  R_Date("SHA_2005.062.04", 6521, 75);
  R_Date("SHA_2007.092", 6518, 73);
  R_Date("SHA_2006.074", 6516, 75);
  R_Date("SHA_2005.061.02", 6513, 75);
  R_Date("SHA_2002.022", 6512, 52);
  R_Date("SHA_1998.004", 6506, 75);
  R_Date("SHA_2005.062.01", 6505, 74);
  R_Date("SHA_2004.039", 6500, 42);
  R_Date("SHA_2005.067", 6499, 76);
  R_Date("LOK_1990.044.01", 6494, 73);
  R_Date("SHA_2003.032", 6492, 73);
  R_Date("SHA_2006.069.02", 6488, 75);
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R_Date("SHA_2004.048.01", 6469, 51);
R_Date("SHA_2005.060.02", 6456, 75);
R_Date("LOR_1998.014", 6448, 76);
R_Date("SHA_2007.090", 6445, 76);
R_Date("SHA_2004.055.01", 6440, 75);
R_Date("SHA_2004.050.03", 6439, 69);
R_Date("SHA_2006.069.01", 6436, 73);
R_Date("LOK_1980.022.03", 6435, 54);
R_Date("SHA_2004.056.02", 6433, 70);
R_Date("SHA_2004.047", 6432, 51);
R_Date("SHA_2006.075", 6431, 74);
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R_Date("SHA_2004.053.02", 6412, 75);
R_Date("LOR_1980.003.01", 6411, 74);
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R_Date("SHA_2006.083.02", 6402, 74);
R_Date("SHA_2005.061.01", 6399, 76);
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R_Date("LOK_1981.024.01", 6388, 74);
R_Date("LOK_1985.033", 6388, 73);
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R_Date("SHA_2003.026.02", 6373, 73);
R_Date("LOK_1981.025.05", 6369, 78);
R_Date("LOK_1981.024.04", 6367, 76);
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R_Date("SHA_2004.052.01", 6320, 76);
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R_Date("SHA_2005.059.02", 6296, 75);
R_Date("SHA_2001.016", 6292, 69);
R_Date("SHA_2008.108.02", 6286, 72);
R_Date("LOK_1980.022.02", 6285, 70);
R_Date("SHA_2007.096.02", 6282, 69);
R_Date("SHA_2005.063.01", 6278, 75);
R_Date("LOK_1980.007", 6274, 73);
R_Date("SHA_2008.112", 6272, 75);
R_Date("KIT_1880.004", 6269, 73);
R_Date("LOK_1981.025.03", 6267, 73);
R_Date("GAL_Grave17-2", 6266, 74);
R_Date("LOK_1988.039", 6250, 73);
R_Date("SHA_2007.086.02", 6244, 73);
R_Date("SHA_2006.083.01", 6240, 76);
R_Date("KIT_1880.011", 6233, 73);
R_Date("LOK_1980.006", 6229, 73);
R_Date("UBE_1962.005", 6224, 72);
R_Date("LOK_1985.030.01", 6217, 73);
R_Date("SHA_2005.060.01", 6206, 75);
R_Date("SHA_2007.086.01", 6205, 75);
R_Date("UBE_1962.008", 6188, 73);
R_Date("GAL_Grave18", 6176, 74);
R_Date("GAL_Grave17-1", 6172, 73);
R_Date("SHU_1972.002.01", 6167, 74);
R_Date("LOK_1981.025.02", 6161, 73);
R_Date("UBE_1962.009.00", 6141, 72);
R_Date("LOK_1981.024.05", 6133, 74);
R_Date("LOK_1980.009", 6128, 73);
R_Date("LOK_1981.023", 6118, 76);
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R_Date("LOK_1985.035", 6041, 76);

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R_Date("SHA_2008.104", 5977, 69);
R_Date("SHA_2008.108.01", 5955, 72);
R_Date("SHA_2003.030", 5953, 72);
R_Date("SHA_2004.044.01", 5952, 52);
R_Date("ROZ_2008.003", 5939, 74);
R_Date("SHA_2004.042.01", 5921, 73);
R_Date("SHA_2008.108.03", 5915, 72);
R_Date("SHA_2005.064.01", 5902, 74);
R_Date("SHA_2003.035.01", 5877, 72);
R_Date("SHA_1998.006", 5875, 74);
R_Date("SHA_2005.059.01", 5835, 75);
Span("EN dated events");
Interval("duration EN");
};
Boundary("EN End/MN Start")
{
  Start();
  Transition();
  End();
};
Phase("MN n=0")
{
  Interval("duration MN");
};
Boundary("MN End/LN Start")
{
  Start();
  Transition();
  End();
};
Phase("LN n=22")
{
  R_Date("ISA_1932.002", 4715, 71);
  R_Date("UID_1989.025.03", 4710, 71);
  R_Date("UID_1988.018", 4710, 71);
  R_Date("UID_1991.038", 4670, 75);

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R_Date("UID_1989.020.02", 4655, 75);
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R_Date("UID_1994.054", 4617, 74);
R_Date("UID_1989.021.02", 4597, 70);
R_Date("UID_1987.005", 4596, 73);
R_Date("UID_1989.020.01", 4584, 71);
R_Date("UID_1989.026.05", 4578, 74);
R_Date("SHM_1976.001.01", 4572, 61);
R_Date("UID_1994.053.01", 4548, 71);
R_Date("SMS_1986.019.05", 4546, 61);
R_Date("SMS_1987.029.02", 4534, 60);
R_Date("SMS_1986.019.01", 4507, 61);
R_Date("SMS_1986.017", 4412, 61);
R_Date("SMS_1986.011.01", 4363, 61);
R_Date("SMS_1986.011.04", 4359, 59);
R_Date("SMS_1986.019.02", 4283, 61);
Span("LN dated events");
Interval("duration LN");
};
Boundary("LN End/EBA Start")
{
  Start();
  Transition();
  End();
};
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  R_Date("GO2_1996.003", 4221, 72);
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  R_Date("GO2_1995.002", 4145, 71);
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  R_Date("OBK_1971.013", 4021, 51);
  R_Date("MAK_1992.018", 3986, 51);
  R_Date("KUR_2003.025", 3938, 60);
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R_Date("SMS_1986.013", 3737, 60);

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R_Date("SHA_2008.107", 3531, 67);
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Span("EBA dated events");
Interval("duration EBA");
};
Boundary("EBA End")
{
  Start();
  Transition();
  End();
};
};
};
```

November 30, 2015

Dear Editor,

We have just submitted our revised paper “*Chronology of Middle Holocene hunter–gatherers in the Cis-Baikal region of Siberia: Corrections based on examination of the freshwater reservoir effect*”.

The paper has been reworked following the suggestions and comments provided by the two reviewers. We found both assessments very helpful and we agree with most recommendations. We would like to note that it is clear that both reviewers support the general approach and appreciate the changes made to the previous draft. We understand, however, that the paper still needed some work although not as much as after the original submission.

The following is a list of changes made to the current manuscript:

1. The method of combining radiocarbon dates has been changed slightly and now follows the suggestion of Reviewer 1. The method is now explained in a new section dedicated to this matter (4.3. Combining radiocarbon dates).
2. The use of a new method of combining dates required running the entire statistical analysis again. This, as expected, didn't make much difference to the overall results but all numbers (e.g., the “r” and “p” values) changed slightly and were accordingly updated in the text, figures, tables, and supplements.
3. We explained and justified why the R_Combine function was preferred over the Combine function to combine radiocarbon dates.
4. We also explained why using the trapezium distribution for the Bayesian modeling in some instances produces Spans that are longer than the Intervals.
5. We decided not to make the case for the presence of two phases of cemetery use at Shamanka II stronger, as implicitly suggested by Reviewer 1. We believe that we dealt with this matter adequately and that the paper was already long enough to expand this matter further. Besides, there are sufficient references in the paper that the matter is discussed in more detail in a separate study soon to appear in print too.
6. Regarding the point by Reviewer 1 that “the interpretation seems back-to-front” (p.18, para.3), we agree and the interpretation was changed.
7. Regarding the general comment made by Reviewer 1 that correlations between date and isotope values need to address the matter of diet composition, we added a new paragraph to the section discussing the EN Angara and the section on the EN Southwest Baikal was revised too. The section on the EBA Little Sea already had enough information about this matter.
8. Since much of the work reported in the paper was completed prior to the conception of the Baikal–Hokkaido Archaeology Project, in some places we use ‘Baikal Archaeology Project’—our former name. We agree that this may confuse some readers a little, but to credit BHAP for the work done by BAP would not be fair.
9. The Conclusions were somewhat revised, including the statement pointed out by Reviewer 2.

10. The entire paper was screened for minor errors including those identified by the reviewers.

In addition to the above changes, one entirely new section was added to the paper. In the light of the discussion in the section on dietary patterns in the EBA Little Sea sample, in which the Upper Lena micro-region is mentioned quite frequently, we considered it useful to add a section on the EBA Upper Lena. This new section expands and clarifies some of the points made in the section on the EBA Little Sea. In a way, these two sections complement one another.

We trust that these changes are satisfactory to proceed to the production stage.

Kind regards,

Andrzej Weber