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Burnt bones by Europe's largest lake: Zooarchaeology of the Stone Age and Early Metal period hunter-gatherers at Lake Ladoga, NW Russia

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ABSTRACT

Lake Ladoga, Europe's largest lake, is situated in northwest Russia east of the Baltic Sea. This article is the first compilation of all the zooarchaeological material recovered from the Stone Age and Early Metal Period hunter-gatherer sites in the area analysed and published up to 2014. All the faunal remains preserved in the acidic soils are small pieces of calcined bone, except for two sites where anaerobic conditions have also preserved unburnt bones. An overview of the analysed assemblages, including identified species and carcass treatment is presented, and the chronological trends briefly summarised. Based on the zooarchaeological material the prehistoric subsistence base was aquatically oriented throughout the Stone Age and Early Metal Period. Day-to-day subsistence seems based on fishing near the campsites, supplemented with seasonal food sources. Prehistoric inhabitants of Lake Ladoga were also committed to invest technology, time, and human resources in the specialised, risky sealing forays. The abundant lake resources offered a stable, self-renewing resource base for the area's population and, for example, fishing maintained its importance in subsistence even after the introduction of cultivation – in places into the 20th century.

1. Introduction

Lake Ladoga, Europe's largest lake, is situated in northwest Russia east of the Baltic Sea (Fig. 1). Since the collapse of the Soviet Union the area became the stage for a fresh upsurge of Finno-Russian archaeological co-operation (e.g. Lavento, 2008; Lavento et al., 2001; Nordqvist et al., 2009), illustrated by the rapidly growing records of archaeological sites (Nordqvist et al., 2008) and informed by modern techniques such as radiocarbon dating (see Kulkova et al., 2012, 2014; O. Seitsonen et al., 2012) and faunal analyses (see S. Seitsonen, 2008, 2010; and this paper).

In this paper we compile all the information about faunal material recovered from the Stone Age and Early Metal Period hunter-gatherer sites in Lake Ladoga area, analysed and published at least in a report form up to 2014 (also S. Seitsonen, 2008, 2010). Based on these data we present a long-term overview of the faunal assemblages and patterns from c. 8600 cal BCE to CE 300. Practically all the faunal remains preserved in the acidic soils of the area are tiny fragments of calcined and burnt bone, apart from two exceptional sites where anaerobic conditions also preserved unburnt bones. Fragmented material presents special challenges for the methodological and analytical approaches adopted, owing to the complex taphonomic processes affecting the formation of burnt bone assemblages. It is also one obvious reason why zooarchaeological studies have previously been very scarce in the area.

First we present a brief overview of the methodological and theoretical issues that need to be taken into account when studying the heavily calcined and burnt bone remains, and describe the analytical framework adopted. Then we describe the study area and its palaeoenvironment, the chronological framework used, and the zooarchaeological material. We present overviews of the analysed assemblages, identified species, and carcass treatment, and finally, summarise some temporal trends observed in the materials corresponding with the chronological periods.

2. Study of the burnt faunal remains

Almost all of the Stone Age and Early Metal Period faunal material in the Lake Ladoga area, as well as in the wider region, consists of heavily fragmented calcined and burnt bone, which rarely exceed 1 cm^3 and a few grams in size due to the acidic soil environment and various post-depositional processes (e.g. Fortelius, 1981; Mannermaa and Deckwirth, 2010; Ukkonen, 2001). This necessitates that special attention is paid to the taphonomic factors affecting the zooarchaeological

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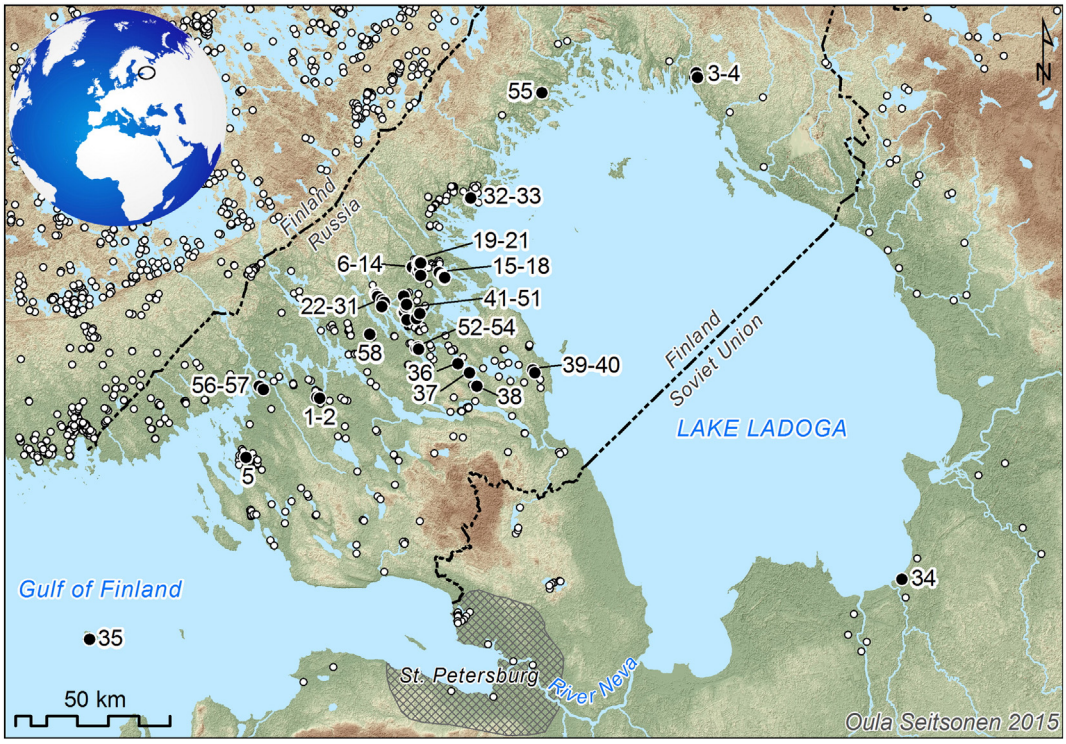

Fig. 1. Location of the study area, and Stone Age and Early Metal Period sites: Sites with analysed zooarchaeological assemblages with black, numbers refer to the Supplementary Material 1, other sites with white (illustration: O. Seitsonen, based on the KarAS database [see Seitsonen et al. 2012]).

assemblages, since the survival of burnt bone is a complex and varied process (Fortelius, 1981).

When a bone is exposed to heat, its organic content burns out, which improves the survival of the remains, but at the same time the remaining inorganic matter is twisted, shrunken and fragmented (e.g. Fortelius, 1981: 4–5; Ukkonen, 2001: 12–13). This process complicates the identification of species, and demands close familiarization with the calcined remains from the researcher. If the researcher is predominantly used to working with unburnt remains, the identifications can easily become biased (below).

Mikael Fortelius (1981) was the first to write a manual for the analysis and possible sources of error for the burnt bones in the Baltic area, instigated by his pioneering analyses of Finnish burnt materials. Taphonomic processes leading to an excavated, fragmented burnt bone assemblage are multifaceted, and numerous sources of bias have to be taken into account. For instance, the numbers of small species with characteristic small bones (such as certain fish species) are often overrepresented in burnt assemblages, and the bones of different animal species have varying compactness and mineral content which affect their preservation (Fortelius, 1981: 5, 9–15; Lyman, 1984; Ukkonen, 2001: 13–14; Vaneeckhout et al., 2013). Also some commonly used approaches, such as the calculation of Minimum Number of Individuals (MNI), itself a debated measure (e.g. Plug and Plug, 1990), and age definitions and bone metrics work poorly with burnt assemblages (Fortelius, 1981: 6–7; Lyman, 1982: 359).

Researchers in Finland, in particular, have presented contrasting opinions about the usability of quantitative methods in the study of burnt assemblages (see Fortelius, 1981; Halinen, 2005; Mannermaa, 2008; Matiskainen, 1989; Mökkönen, 2001; Siiriäinen, 1982; Ukkonen, 1996, 2001, 2004; Vaneeckhout et al., 2013). For instance, a close correlation is typically observed between the Number of Identified Specimens (NISP) and the number of identified taxa in the burnt assemblages, which can bias the ratios between contexts and sites depending on the assemblage size (see Grayson 1984; Mannermaa, 2003; S. Seitsonen, 2008, 2010): this correlation seems to be highest in assemblages with lower NISP and to lessen as the NISP gets higher (Fig. 2).

Pirkko Ukkonen (1993) has suggested a more robust way of quantifying the burnt material alongside NISP by enumerating the number of discovery sites (also Ekman and Iregren, 1984): recently this has been described as *Ubiquity* (see Lyman 2012: 114; Popper 2008), which name is used also here. As an example of the importance of taphonomic perspectives when interpreting burnt assemblages, Oinonen et al. (2014: 1424) proposed on the basis of Stone Age refuse faunas "a moose [elk] population explosion" facilitated by the regression of Lake Saimaa, which drains into the Lake Ladoga. However, although elk (*Alces alces*) was identified at 10 out of 30 sites included in their sample, 90% of the elk bone fragments (313/347) originate from a single site with an anomalous bone assemblage; without this anomalous site only 34 elk fragments would have been identified for the discussed period (Mökkönen and Nordqvist 2014). In this paper, the results of zooarchaeological analyses are discussed based on examination of both the NISP and the Ubiquity (classified as the dominance/presence/absence of a species at a site), and also on MNI for the unburnt Ladoga

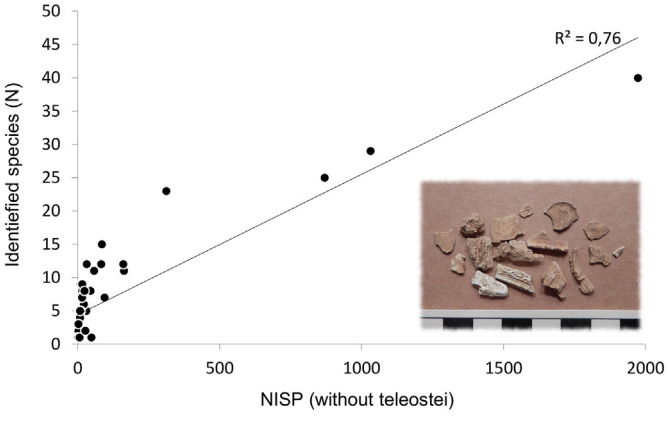

Fig. 2. Correlation of the NISP and the number of identified taxa in analysed assemblages; inset: burnt bones from the Räisälä Hiekka 1 site (illustration: O. Seitsonen).