

## General Comments

This manuscript essentially summarizes more than two decades of research on stratified ice-wedge-filled lacustrine deposits indicative of interglacial warmth at two nearby sites in NE Siberia: Bol'shoy Lyakhovsky Island and the Oyogos Yar coast. Much of the biostratigraphic evidence has been published previously in specialty journals but is helpfully summarized and compared here, and includes important new geochronological evidence confirming an Eemian (MIS 5e) age and summarizes all of the biostratigraphic evidence in climate terms. As such, this is a very useful synthesis for the Quaternary community and is well suited for *Climate of the Past*. It provides an important synthesis of a massive amount of work, including a wider range of climate proxies than for almost any other LIG Arctic site. I am not especially familiar with these deposits, but there is quite an extensive literature on them.

An OSL expert should review those results as these are essential to the story and as near as I can tell, have not been previously published, whereas much of the other data have been published in specialty journals previously. I have no reason to be suspicious, although the stated precision is somewhat better than most OSL ages in this time range.

There are an amazing amount of specific analytical results, all at least modestly useful, but certainly not of equal informative power. Still, the less significant results take up less space and document the breadth of effort put into these studies.

Paragraph indents would have been very helpful

## Specific Comments

**Abstract** This should be a single paragraph that succinctly explains what is newly published in this paper and what is being summarized from previous (mostly proxy-specific) publications. And ending with a summary of what the authors think are the key interpretations for Eemian climate (both winter and summer), how these compare with model-based reconstructions and what appears to be the important factor of the higher Eemian sea level, and ending with how what they have learned has relevance for predictions of future Arctic warming in an enhanced greenhouse world. The current abstract is several paragraphs long and reads more like an Introduction than an Abstract.

Specific comments by page and line number

### p.2 Abstract

**Line 16** *sedaDNA* not *sedDNA*; looks OK in main text

**Line 11.** *"new luminescence ages"* Are the luminescence dates new with this publication? If so, then line 8 might best read *"Here, we present new geochronological results and synthesize cryolithological, ...."*

**Line 19:** *"proxy data and also paleoclimate model results indicate a regional LIG climate significantly (ca. 5 to 10 °C) warmer than today"* What region? Maybe make this specific to high northern latitudes?

**p.3 Line 19** *"The globally warmer-than-today Last Interglacial (LIG, ca. 130-115 ka)*

Do we really know LIG is globally warmer than today? The primary forcing (insolation) is limited to Northern Hemisphere summer and is actually negative for summer in the S Hemisphere. Rising sea levels from NH ice sheets can destabilize some of Antarctica without warming. The Holocene appears to show no early Holocene warmth globally but strong early Holocene warmth in the Arctic...can Eemian be the same? This needs a reference if the authors want LIG warmth to be global.

**p.8 Line 20 and following**      **3.2 Luminescence dating**

The section on Luminescence dating is important because it seems to be new results that confirm the age of the deposits to be indeed MIS 5e. Please clarify when the sampling occurred and when the analyses were made and whether the dates cited came from only one of the two sites. Were earlier efforts inconclusive? Is this the first time these MIS-5e dates are being published? Can you show a section where the OSL samples were taken and the context of other biostratigraphic samples in the same section. This seems important to convince the reader that the dates have direct relevance to the climate reconstructions.

There are no citations in Section 4.2 *Luminescence dating*, hence I gather these results have not been previously published, and should be reviewed by an OSL expert.

**p.10 Top**

Pollen data are discussed in terms of processing, but no mention of how to deal with pollen from taxa with highly efficient wind-dispersal mechanisms. Particularly *Alnus*, *Salix*, and *Betula* that are very efficiently wind transported. However, it appears that actual plant fragments of at least *Betula* and *Alnus* were recovered. I suggest presenting the plant macrofossil evidence first as its authenticity for on-site plant growth is much higher than for pollen, especially for taxa dependent on wind dispersal of their pollen.

Table 2 is very helpful in this regard

Also a discussion on page 37 addresses some of these issues

**Fig 4** very helpful and convincing for ID of Eemian

**p.12 Section 3.5 *Clumped isotope analysis of biogenic carbonates and derivation of lake water  $\delta^{18}O$***

*Wouldn't this make more sense to read: **Clumped isotope derived lakewater paleotemperatures***

**p.30-32 5.2 *Last Interglacial chronology and dating uncertainties***

I'm not sure the summary of the range of ages available is essential here. Seems like focusing on luminescence techniques, as that is all that is presented for age control of these deposits. Other dated deposits are listed but as those results are not really discussed, I don't see why they are relevant to the paper. Although Fig 11 is somewhat helpful even though not particularly relevant to the main thrust of this paper.

Section 5.3 is important and very helpful, as is Table 7

**p.36, line 13** “farther vs further” “farther describes physical distance; further describes figurative distances”

**p.38&39 Conclusions**

This is the one paragraph that most “general readers” will look to. Page 39 first paragraph discusses the temperature estimates from a range of proxies, especially warmest month. But it gets a bit muddled on exactly “how much warmer than present day”, or pre-industrial, summer temperature estimates they are. It would be very helpful to have a better presentation of

- 1) Recorded summer temperatures (or estimated pre-recent-warming warmest month temperatures
- 2) The range of LIG estimated warmest month temperatures for the various proxies and an attempt to summarize how these might be compared to contemporary measured air or lakewater temperatures
- 3) The modeled Eemian warmest month temperatures

And then the discussion of how a higher sea level during teh Eemian may in its own altered warmest month temperatures

This section is so important to the general reader that a bit more effort to distill all their amazing data into a comprehensive summary is important.