

Interactive comment on “Vegetation history of Central Chukotka deduced from permafrost paleoenvironmental records of the El’gygytgyn Impact Crater” by A. A. Andreev et al.

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Summary This is a useful study that provides complementary data to the Lake E pollen record, derived from terrestrial sediment cores. In the Arctic the higher pollen production of woody taxa means that pollen records are biased towards them. Additionally, a large lake such as Lake E will further integrate the regional pollen signal at the expense of the local. Thus, local terrestrial records can help redress the bias. Additionally, macrofossils may be present. The data are well presented in Figures and well described. However, it would be useful to see a deeper discussion of the pollen over-representation issue by species and a more nuanced discussion of the climatic

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implications. As currently written, the paper rather rushes through some interesting details and heads towards what one suspects is the “expected” conclusion. In doing so, some interesting points are missed that could provide extra interesting discussion.

First, *Larix* is not renowned for over-representation or long-distance transport, whereas *Alnus* and *Pinus* are. Some references to this would be useful. Also some information on the current distribution of these taxa and clearer information about their past records would be useful. Perhaps a map?

Second, it is recognized that the climate implications of the Lake E core are compromised by the long-distance pollen. But the terrestrial records have their own problems of interpretation. In some places, differences between terrestrial records are attributed in the manuscript to local variation in vegetation (presumably due to different site conditions and processes). In contrast, P2 shows an interesting Younger-Dryas type fluctuation in the pollen, whereas P1 does not. Here the P2 record is interpreted as a major climate change, but no possibility of site differences is considered. This is especially important to think about as the highest woody taxa values come from organic-poor pre-Holocene sediments (itself rather interesting and could be the subject of more discussion).

Finally, the ¹⁴C dates are not bad at all for a landscape subject to permafrost processes of slope movement. There are, however, major hiatuses, and it would be good to begin the interpretation by linking the dates and any information from the sediments themselves to possible slope processes that might confound the record (hopefully dismissing this possibility – but it needs to be considered).

The paper is generally well written but the English needs reviewing and correcting by a native English editor. There are numerous small errors.

Comments related to points in the text

1410-23 – longest archive within what region?

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1411-3 et seq. – text conflates extra-regional records (spatial scale) with long temporal records – while there is some correlation generally, the nature of the differences between temporal and spatial scales of the two records in question should be clarified.

1412-1 et seq – it's not really permafrost per se, but rather permafrost-affected sediments, and we need to know what type of sediments.

1412-17 round=spherical?

1412-22 please clarify what you mean by “loose” sediment

1413-5 Characterizing the modern climate around El'gygytyn Crater Lake, an oceanic influence is distinctively expressed in decreasing summer temperatures and resulted in the thermal inertia of the crater area (Kozhevnikov, 1993). Not clear what this means. Please clarify.

1413-12 Clarify what is meant by single shrub alder stands

1413-18 Please give a source for the terminology you are using for vegetation zones

1416-3 et seq. Given the core sediment is interpreted as derived from various forms of mass wasting transport, and that the sediment accumulation rate is extremely uneven, I think it would be useful to discuss the reliability of the profile as regards possible hiatuses or redeposition of material out of temporal order. Where are the last 3000 years? Is this the functional radiocarbon age of modern soils (due to slow decomposition and/or frost heave)? If so, what is the “real” age of the underlying sediments? For example, between 240 and 270 cm is an apparent age gap of about 3000 years.

1416-25 Do the surface samples show Larix as a long-distance pollen grain at the site today? I have generally understood Larix pollen to be poorly distributed and likely to reflect local production. Why do you assume it is long-distance transport? Perhaps such an assumption should be left to the Discussion, especially as in P2 you report macrofossils.

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1420-23 Now Larix pollen is interpreted as being local (see above)

1421-19 It would be better to present the pollen diagrams with calibrated ages as that's what you use to discuss them in the text. You might point out that the date of 11, 160 14C is in the middle of zone I at P1 and you have no dating control between that and the cluster of dates ~10,000-9000 higher up. The upper part of zone I may be younger than 13,000 cal yr BP.

The dates are not showing properly on Figure 4.

1422-25 et seq – I feel slightly uncomfortable that the nature of the sediment changes and discontinuities is not examined independently from the pollen record. There is a tendency here to assume this is the “Allerod” and therefore must be warm and wet and thus cause the sediment and pollen changes observed. There probably is a relationship, but hiatuses or active slope movement could also create artifacts, or truncate sequences, and this is not considered.

Authors in Beringia generally do not use “Allerod” to describe late-glacial phases. I agree that the P2 record shows a reversal to less shrubs and more graminoids during a period that includes Younger Dryas time, and I think that you should suggest that this is quite interesting and unusual, and not just assume that the YD oscillation should be present at this site. It is not everywhere in Beringia (see Kokorowski et al 2008). If Matrosova in her papers refers to the YD please report it here for non-Russian readers.

1424-12 The values of Alnus?

1426-3 Andreev et al 2011 appears to be missing from the reference list.

Found larch remains document that larch grew in approximately 100 km from its modern northern distribution limit. Not quite sure what “from” means: beyond or within? North or South?

1426-18 Refer to Fig 1 to locate the Enmyvaam River valley. The rest of this paragraph should be clarified. Are you saying that macrofossil remains date to no later than 7400

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but the pollen values remain high far longer?

1426-25 et seq. Replace contents with values.

1427-5 It might be useful to know where the current limit of stone pine is in relation to the study site.

1427-14 et seq. Before concluding, if the long-distance vs local presence of shrubs and trees at the site is a key element in your analysis, it might be useful to devote a small section to this in the discussion. I agree that it is a difficult problem in the north, and being able to distinguish local vs regional pollen rain is important in making palaeoenvironmental reconstructions. So I would increase the prominence of this part of the study (and also ensure that your statements about the different species do not contradict – see *Larix* above)

1428-3 et seq. Earlier, you point out, quite reasonably, that differences in pollen spectra between the sites might reflect differences in local development of the vegetation. Typically, highly local records are not the most reliable climate records. Here you assume that the pattern observed at P2 (it is not clear really that it appears at P1) is now a regional climate record.

It would be better to highlight that P2 apparently shows a clear reversal that corresponds to YD time (interesting), although P1 not so clear. This could be a relatively local phenomenon, or it could be a real reflection of the regional signal.

It also seems interesting that the shrub values in P2 are higher in the “Allerod” than they are in the early Holocene, even though you emphasize the early Holocene as the key time for climate warming (at least as suggested by other regional records and records of treeline shifts). Why then are the values so high in P2 early in the record? Do you think the climate was even warmer then? There is little or no TOC in the earlier (pre-YD) part of the core. What are the likely issues with respect to pollen preservation and/or the growth potential for shrubs on this earlier form of substrate?

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Interactive comment on *Clim. Past Discuss.*, 8, 1409, 2012.

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