

## ***Interactive comment on “Pleistocene climate characteristics in the most continental part of the northern hemisphere: insights from cryolithological features of the Batagay mega thaw slump in the Siberian Yana Highlands” by Kseniia Ashastina et al.***

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Received and published: 22 December 2016

Review of COPD “Pleistocene climate characteristics in the most continental part of the northern hemisphere: insights from cryolithological features of the Batagay mega thaw slump in the Siberian Yana Highlands by K Ashastina, L Schirrmeister, M. Fuchs, and F. Kienast

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General comments:

I would best describe this paper as a reconnaissance of an important new exposure in the interior of Yakutia. The site is remarkable in its height and no doubt was a very difficult exposure to work. I have worked on similar sites in Alaska and so commend the authors on the amount of information and samples they were able to collect from the site. It is no small task and I appreciate their comments about the danger of some parts of the exposure.

The stated purpose of the paper, and I assume the choice of journal, is to reconstruct the climate of this interior continental site in central Siberia via cryolithological reconstruction. It does this generally through reconstruction of the depositional environments, and to some extent the record of active ice wedges and some plant macrofossil data. The cryofacies part is not well developed and I think, particularly for the origin of Unit IV this could be useful. On this theme were there no water isotope samples collected for the site? These would be useful for the origins of Unit IV. The choice of journal did not seem immediately obvious, but that being said, the largely lithological reconstructions in the paper, coupled with paleobotanical data, do represent proxy records that tell us about past climate for this region.

I read the paper with interest given the location of the site, but that being said I was a bit disappointed that the chronology did not work out better to allow a clearer identification of the MIS 3/2/1 units (via radiocarbon) coupled with the OSL dating for the lower purported MIS 5 units below. The radiocarbon dating is sparse and I am surprised of the uncertainty toward the top of the exposure, particularly given the presence of the Arctic ground squirrel midden. Only a single sample was dated from this midden, but an abundance of discrete macros must be available, no? And the suggestion that the AGS may have burrowed below the overlying 33ka data is unlikely- modern AGS's are well established in that they will only burrow to the depth of the active layer and they tend to only be present on sites with thicker active layers (up to 1m or so). This is well established in the North American literature. An additional age on this nest should

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confirm if the 26ka date is accurate, with the implication of a problematic overlying age or reworked macrofossil from older deposits.

In terms of evaluating the radiocarbon, are there any QA standards from the radiocarbon lab that would allow us to know what background was? Were these small mass samples? Was there a mass-dependent background blank if these were small samples? At present it is hard to evaluate the contradictory radiocarbon results and I would assume given the sequential lab numbers the radiocarbon lab would be able to provide additional information that may help with understanding these inconsistencies- i.e. are these inconsistencies reflecting reworking of older macrofossils or reaching background with small mass samples or some other problem?

The stratigraphic reconstruction the authors present seems quite reasonable and they make a strong case through correlation to the coastal sites in their previous work. In that sense they have set up a useful stratigraphic framework for the site, and no doubt this will enable future work to focus on specific intervals- such as the last interglacial or the MIS3/2/1 interval.

The one question that I think is perhaps of most interest to a broad paleoclimate readership is the extent of thaw during the last interglaciation and whether this question is tractable at the Batagay site. It would appear to be. On p11 they discuss the Unit III layer and indicate a relatively uniform thickness of about 1m reaching up to 3.5m in ice wedge casts? It would be useful to see more documentation of this unit. Are there relict ice wedges below this unit to indicate the depth of permafrost thaw during that time (it would appear so from the descriptions and photos)? What is the nature of the cast fill/thaw unconformity? Were these casts sampled for macrofossils? Our own experience has been that many of the thermophilous taxa are preserved in cast fills (see Kuzmina et al., 2014 Quat. Int.) because of the accommodation space provided in the wedge. Is the infill waterlain/stratified perhaps indicating thermokarst ponds? Or was there relief and the potential for past intervals of retrogressive thaw slumping similar to today? My guess would be the latter. It was not clear to me the relations with

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the underlying Unit IV that seemed to lack relict ice wedges, but they are present in the underlying Unit V. But does Unit IV include relict pore ice? It appears syngenetic and anoxic from Figure 6, but can you add more to this? What was the extent of the thaw of this unit with the unconformity of Unit III? What are the cryofacies/structures of this unit? Is there evidence of thaw and refreezing of this unit epigenetically? Water isotopes would seem a useful tool through this stratigraphic sequence.

Overall, however I do not see any of these comments as being fatal to the manuscript, and I don't expect that all of these questions are tractable from this first investigation of the site, but I do hope future work will be forthcoming. I think the paper is well organized and I recommend its publication in COPD with minor revision to the text for clarity and perhaps some large discussion around the paleoenvironmental significance of the exposure to some broader questions. The Batagay site is remarkable and I think will yield important insight into the ca. 150,000 years or so of earth history preserved at the site and I look forward to reading about it.

Specific comments:

1. Title- It is too long. I suggest Paleoenvironmental reconstruction of MIS 6-1 relict permafrost from the Batagay mega thaw slump in interior Siberia (or some similarly shortened version of the title).
2. Chronology: this is the weakest part of the paper and I'm sure a source of frustration to the authors for understanding the significance of the lithostratigraphic units. For the most part the authors have taken their coastal stratigraphy and applied their understanding to the main units at this site. I think this is entirely appropriate for a reconnaissance survey and no doubt will be followed up with future work to test these correlations through detailed independent chronology.
3. The cryo part is inconsistent. Looking through Table 1, there are cryofacies (or at least some ice descriptions only for a few units) and ultimately no photos of the cryostructures at the site. This would be particularly useful, if they exist for Units 3 and 4 and should be added to Table 1 and perhaps some of the descriptions of the units in the main text where they assist in the interpretations.
4. I'm surprised to not see any

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water isotope data in this paper? Was there a special problem? If the stated purpose is a paleoclimate reconstruction, the water isotopes would be particularly useful for the last interglacial unit in particular and in understanding the origins of Unit IV and the likelihood for Unit V to be MIS 6. 5. Table 4- the authors present a correlation of the main units with MIS's and permafrost dynamics. This is largely based on their correlations to the coastal sites and so I think needs to be restated as more speculative to acknowledge the uncertainties in the dating at the site. It seems likely but it is a supposition. 6. Figure 3 the geological map does not add much in my opinion- I would suggest stating something about the geology in the intro/site description, but dropping this figure. 7. Figure 6- there are no descriptions for panels f or g- which I assume come from units 3 and 5?

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Interactive comment on Clim. Past Discuss., doi:10.5194/cp-2016-84, 2016.