

# ***Interactive comment on “Yedoma Ice Complex of the Buor Khaya Peninsula (southern Laptev Sea)” by Lutz Schirrmeister et al.***

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## REVIEW

Lutz Schirrmeister, Georg Schwamborn, Pier Paul Overduin, Jens Strauss, Margret C. Fuchs, Mikhail Grigoriev, Irina Yakshina, Janet Rethemeyer, Elisabeth Dietze, Sebastian Wetterich “YEDOMA ICE COMPLEX OF THE BUOR KHAYA PENINSULA (SOUTHERN LAPTEV SEA)”

This manuscript is based on complex study of Yedoma deposits of the Buor Khaya Peninsula and provides unique information on Yedoma structure and properties. The paper makes a significant contribution to circum-Arctic Yedoma studies. The manuscript is clearly written and contains valuable information and I strongly support its publication. However, it requires some revision. My comments and recommendations

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are listed below:

Page 1, Title, Line 19, and further. I recommend to use Yedoma instead of Yedoma Ice Complex or Yedoma IC, since these two terms (Yedoma and Ice Complex) are synonyms.

Page 1, Lines 17-18. I'm not sure it makes sense to write about these two methods in Abstract, especially when you mention below that "Two Yedoma IC exposures and one drill core were studied..." (Line 20).

Page 1, Line 31. I recommend to explain term "proluvial" (or replace it with alluvial fen) since this term is not widely used in many countries (in US, for example).

Page 1, Lines 36-37. I recommend to remove this sentence from the abstract (also see my comment for Page 14, Lines 21-24).

Page 2, Line 12. I recommend to add references, since you wrote "commonly found..."

Page 2, Lines 16-18. I recommend to rewrite this sentence – it is not very clear.

Page 2, Line 19. I recommend to explain what do you mean by 85% – modern (mostly ice-wedge degradation), Late Glacial/Early Holocene thermokarst (alasses), or both?

Page 2, Lines 25-26 and further. — see my comment Page 4, Line 15.

Page 3, Lines 12-17. You cite several papers on Yedoma in Alaska and Canada, but there are much more publications on Yedoma in Siberia. I recommend to add several more citations (major papers on Yedoma in Central and Northern Yakutia – the areas adjacent to your study area).

Page 3, Lines 22-23. I recommend to move this sentence to the next section (Study Site)

Page 4, Line 15 and further. What classification(s) did you use for descriptions of cryostrutures? Unfortunately, your descriptions of cryostrutures are not consistent

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through the manuscript, including Figure 3 legend (lens-like/lenticular, lattice-like/net-like/reticular/reticulate, banded/layered, etc.).

Page 4, Lines 22-23 and further (e.g. Page 7, Line 36). There is no absolute ice content in this glossary (van Everdingen 1998). Do you mean gravimetric moisture content? In this case, it should be calculated on a dry-weight basis. Wet-basis gravimetric water content also may be used but this is not very common in the literature. If you want to use it here, you may cite Phillips et al. 2015 (GEOQuebec Conference).

Page 7, section 4.2. I recommend to subdivide this section: 4.2.1. Buo-02 4.2.2. Buo-04 4.2.3. BK-8

Page 7, Lines 21-35 and further. Cryostratigraphic descriptions are not very clear; it will be good to illustrate them with close-up photos. Line 28: I recommend not to use term “massive cryostructure” (this Russian term may be mixed up with massive ice).

Page 8, Line 2 and further. What do you mean by 80.6%? Mean explained variances for these five members make 100% in Table 1. If you mean R<sup>2</sup> total mean (0.806), this should be explained (probably in Methods).

Page 8, Line 7 and further (e.g., Page 9, Line 4). These BD numbers look too low. Such numbers are more appropriate for dry density.

Page 8, Line 22 and further (e.g., Page 9, Line 19). These numbers doesn't match Figure 7.

Page 9, Lines 11-12 and further (e.g., Page 9, Line 22). Are you talking about five or six segments? You show six units in Figure 7, but here you describe five segments only.

Page 9, Line 13. I recommend to mention the vertical foliation and color of ice.

Page 9, Line 26, 34, Figures 4, 6, 8. It looks pretty strange: moisture contents in this core are MUCH higher in comparison with both exposures (see Figures 4, 6, and 8),

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while you describe similar ice-rich soils in all your sections. BD for BK-8 are also much higher (see the same figures), though it is impossible for soils with higher moisture contents. Definitely something is wrong here. I strongly recommend you to check all numbers for moisture content and density (see also my comments for Page 4, Lines 22-23 and Page 8, Line 7).

Page 10, Lines 6-7. I recommend to add this information to Table 2.

Page 11, Discussion. I recommend to subdivide this section in a different way: 5.1. Chronostratigraphy 5.2. Cryostratigraphy and analytical data interpretation 5.3. End-member analysis ????? 5.4. Polygenetic origin of Yedoma soils ????? 5.2 → 5.5. Regional context of Yedoma Ice Complex in eastern Siberia

Page 11, Line 35. You didn't mention the youngest age:  $5.1 \pm 0.05$  (Table 2)

Page 12, Lines 15-17. These sentences are not very clear.

Page 12, Line 18. Wrong numbers – it should be Figures 3 and 5 or Figures 3 to 6.

Page 13, Lines 23-38. I recommend to move these lines to the end of this section and to add references (for the concept of polygenetic Yedoma formation). I also recommend you not to mention glacial hypothesis (Line 34), since almost nobody supports it now.

Page 14, Lines 21-24. 2.5 m is too deep for the active layer in silt, and the wet climate does not support deep seasonal thawing. Maybe it's better to interpret this unit as a refrozen shallow talik. An analysis of cryostructures may help to determine freezing conditions. According to your description (Page 9), this unit looks like ice-rich syn-genetic permafrost, but it's hard to tell without detailed sketches and photos.

Page 25, Table 1. "... performance of original vs. modelled data (using the mean robust end-members)" – This is not explained in Methods.

Conclusions (File bg-2016-283-AC1). I suggest two small changes: 1. The timing of IC formation as well as its cryolithological properties (and temperature) are similar to

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known Yedoma IC sequences in the Laptev Sea region and beyond. —I recommend to remove "and temperature" 2. Three robust end-members (rEMs) represent fine silt, medium silt, and fine sand fractions in grain-size distribution data (and support) WHICH SUPPORTS THE CONCEPT OF MULTIPLE transport and depositional processes. . .

Figures 1-8. I suggest several small changes – see attached file.

Figure 13. For BK-8, I recommend to use different symbols for the dates obtained from soils and ice wedge.

MORE COMMENTS AND SUGGESTIONS ARE PROVIDED IN THE ATTACHED FILE.

Good luck!

Mikhail Kanevskiy, Institute of Northern Engineering University of Alaska Fairbanks

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/bg-2016-283/bg-2016-283-RC1-supplement.pdf>

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