

The Batagay Outcrop – window into the past of North Yakutia’s most continental part.

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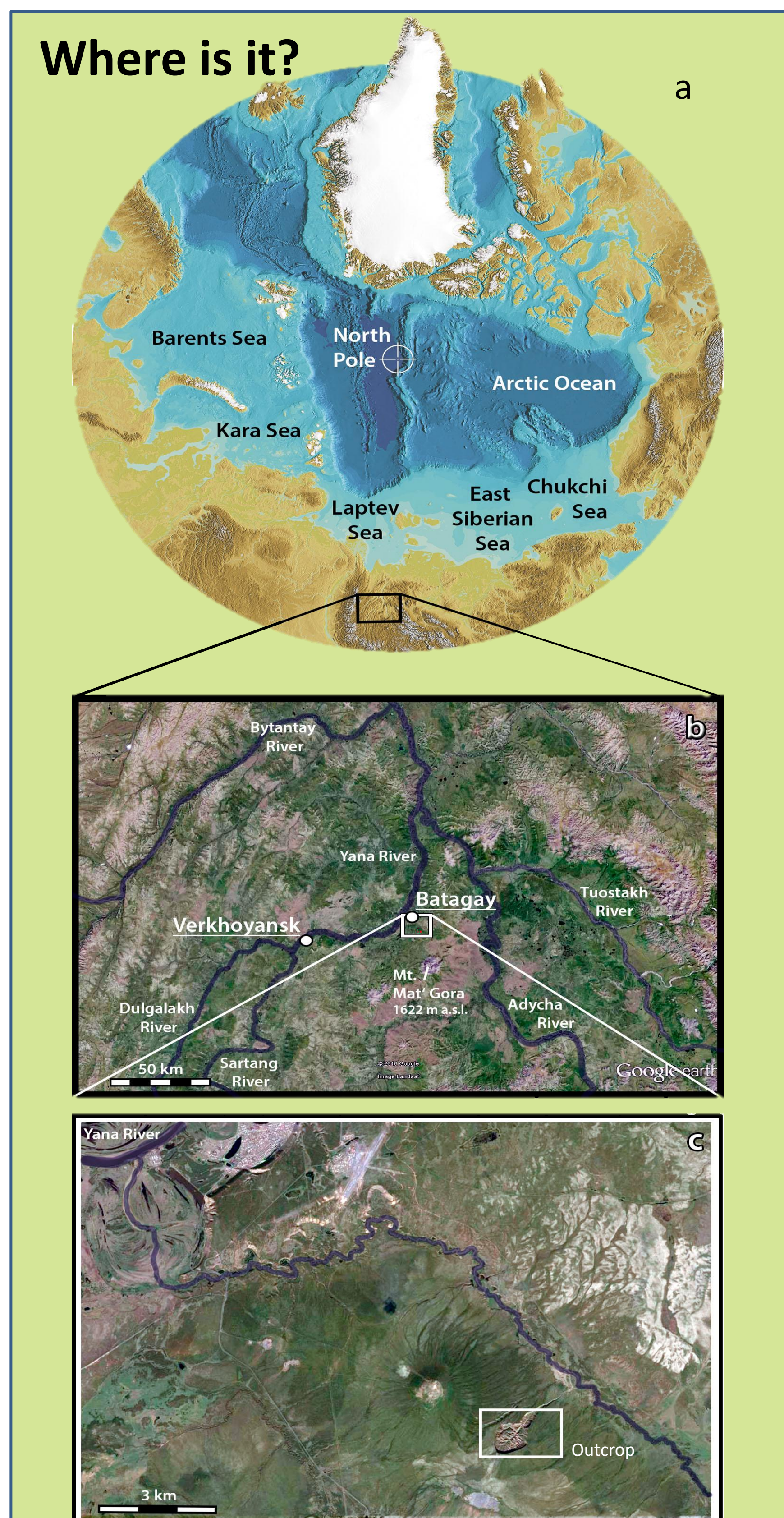


Figure 1. (a) Location of the Yana Highlands in Northeastern Siberia. Map modified from the International Bathymetric Chart of the Arctic Ocean (Jakobsson et al., 2012). (b) Position of the study area on the right bank of the Yana River valley. (c) Location of the Batagay mega slump (framed). B and C modified from Google Earth satellite picture from July 4th 2013, 67°34'41.83"N, 134°45'46.91"E.

Key questions

- What processes governed the sedimentation of the permafrost sequence?
- How old is the material building up the sequence?

Methods

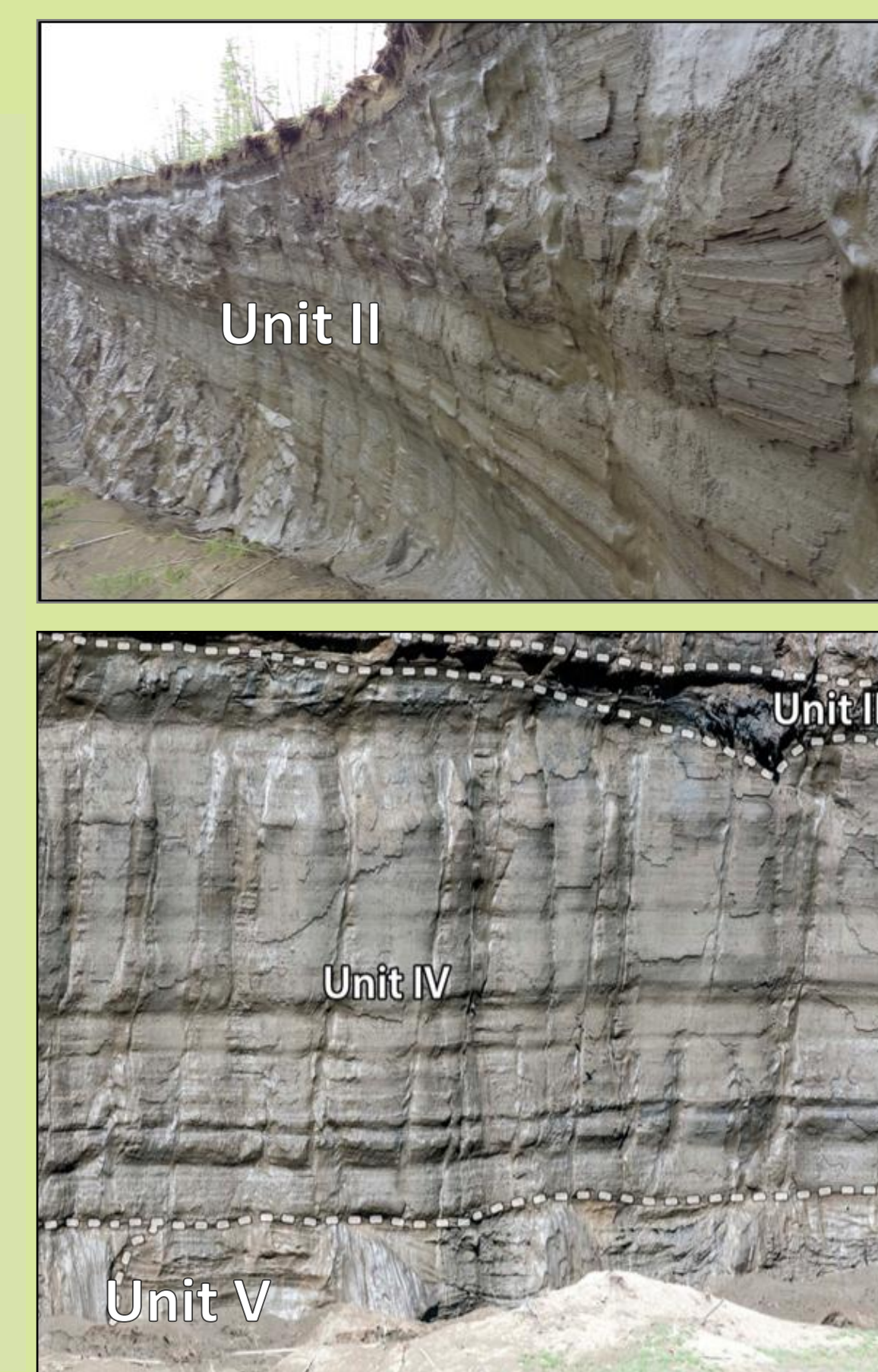
- We took frozen samples every meter along a depth profile from accessible parts of the permafrost wall and along thermokarst mounds (baidzherakhs).
- Each sample was split into two subsamples for parallel sedimentological and plant fossil analyses. Some preliminary palaeobotanical results will be presented in Session 13, ICOP 2016 by Frank Kienast.
- Ages were estimated with OSL (quartz, grain size fraction 63-100µm) and AMS radio carbon methods.

Why is it interesting?

- The area experienced neither maritime climate influence nor glaciations (Siegert et al., 2007). In contrast to the majority of the permafrost exposures, this thaw slump is set aside from rivers.
- Batagay is located close to the current Pole of Cold in the Northern Hemisphere – Verkhoyansk. The average January temperature is -44,7 °C, average Juli temperature is +15,5 °C, precipitation is 181 mm/y (USSR Climate Digest, 1989).
- The mega slump is 800 m wide and up to 110 m deep and developed within just 40 years. The current expansion rate is 15 m/y (Günther et al., 2015).
- 5 stratigraphical units can be already visually identified.



Figure 2. Cryolithological units of the Batagay outcrop.



Results and conclusions

- Batagay outcrop - preliminary chronostratigraphy

Unit	Depth, m bgs	Dating result, ka	Expected stratigraphy
I	0 - 1.4	ca 0.3*	Holocene layer
II	1.4 - 37	>50 to 12.6*	Yedoma IC
III	37 - 40	> 46*	MIS 5e
IV	40 - 55	142.8 ± 25.3**	MIS 5a-d
V	> 55	?	Late Saalian IC

* AMS radio carbon dated, BP
** OSL dated

- In comparison to other Yakutian Yedoma Ice Complex (YIC), e.g. in the coastal lowlands, the Batagay profile is characterized by a higher fraction of fine sand throughout the whole sequence. This might be due to increased aeolian deposition from local sources.
- The threefold division of YIC, unit II, as visible in grain-size parameters and TOC content may reflect three different climate stages, e.g. MIS 4, 3, and 2 during YIC formation.
- Deposition processes of YIC seemed to be seasonally controlled: during the cold winter time, nival genesis deposition could have been dominant, whereas local aeolian deposition prevailed during the dry summer season.

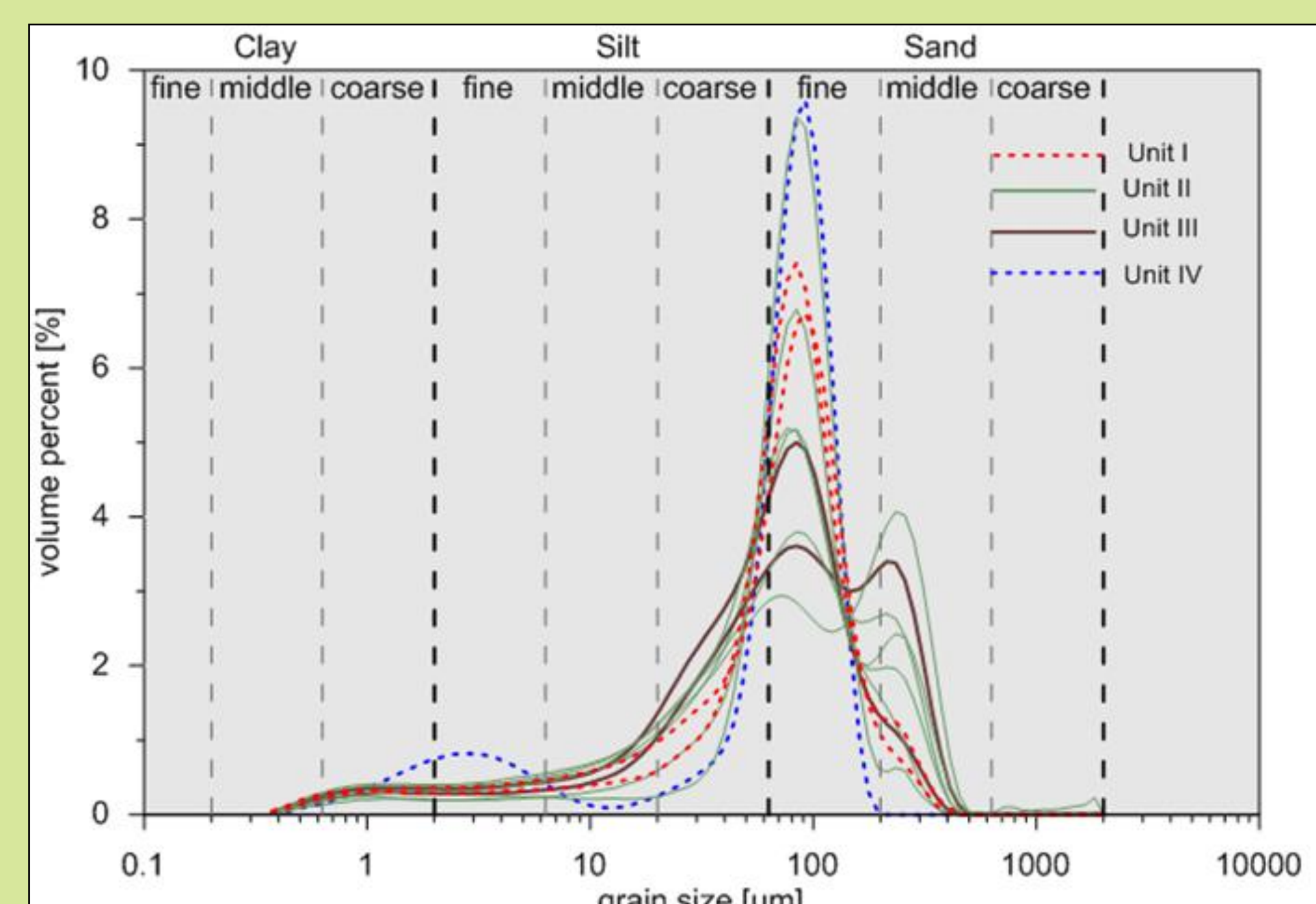


Figure 3. Grain size distribution plot for Units I (n=2), II (n=6), III (n=2) and IV (n=1).

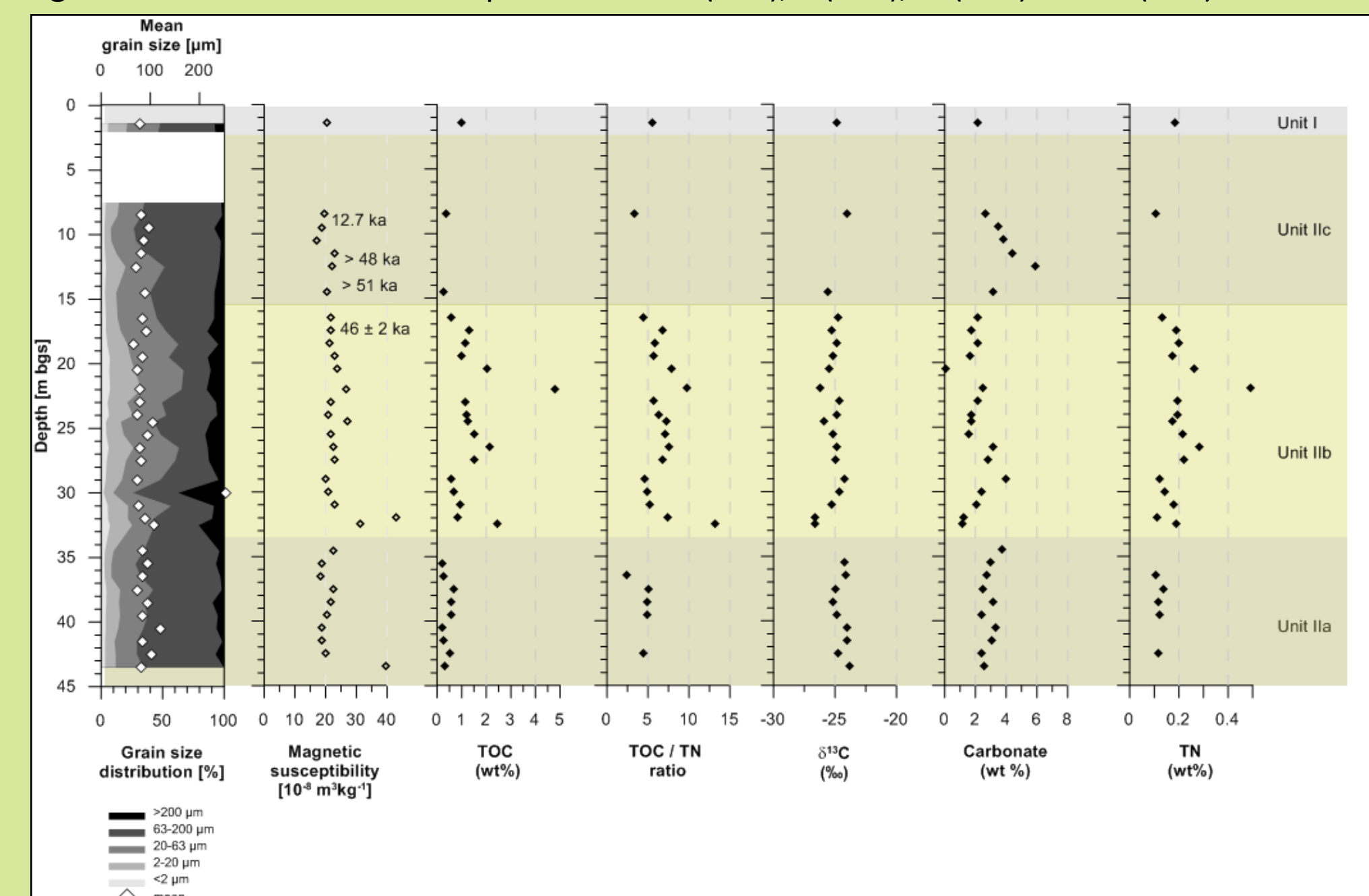


Figure 4. Grain size distribution, magnetic susceptibility, TOC, TOC/TN, δ¹³C carbonate records for YIC of the Batagay outcrop.

References:

- Günther, Frank et al., 2015. *The Batagay mega thaw slump, Yana Uplands, Yakutia, Russia: permafrost thaw dynamics on decadal time scale.*
 Jakobsson, Martin, et al. "The international bathymetric chart of the Arctic Ocean (IBCAO) version 3.0." *Geophysical Research Letters* 39.12 (2012).
 Siegert, Christine, et al. "Development of glaciation in the Verkhoyansk Range and its foreland during the Pleistocene: Results of new investigations." *Regionalnaya Geologiya i Metallogeniya (Regional Geology and Metallogeny)*, No. 30-31 (in Russian), 222 (2007).
 USSR Climate Digest, 1989, Issue 24. Yakutskaya ASSR. Meteorologicheskies dannye za otdelnie gody. Chast 1. Temperatura vozdukh/ Red. vyp. Izjyemenko S.A. Yakutsk: Yakutskij gidrometeorologicheskij zentr, 544 s.

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