Ground-ice stable-isotope paleoclimatology at the Batagay megaslump, East Siberia

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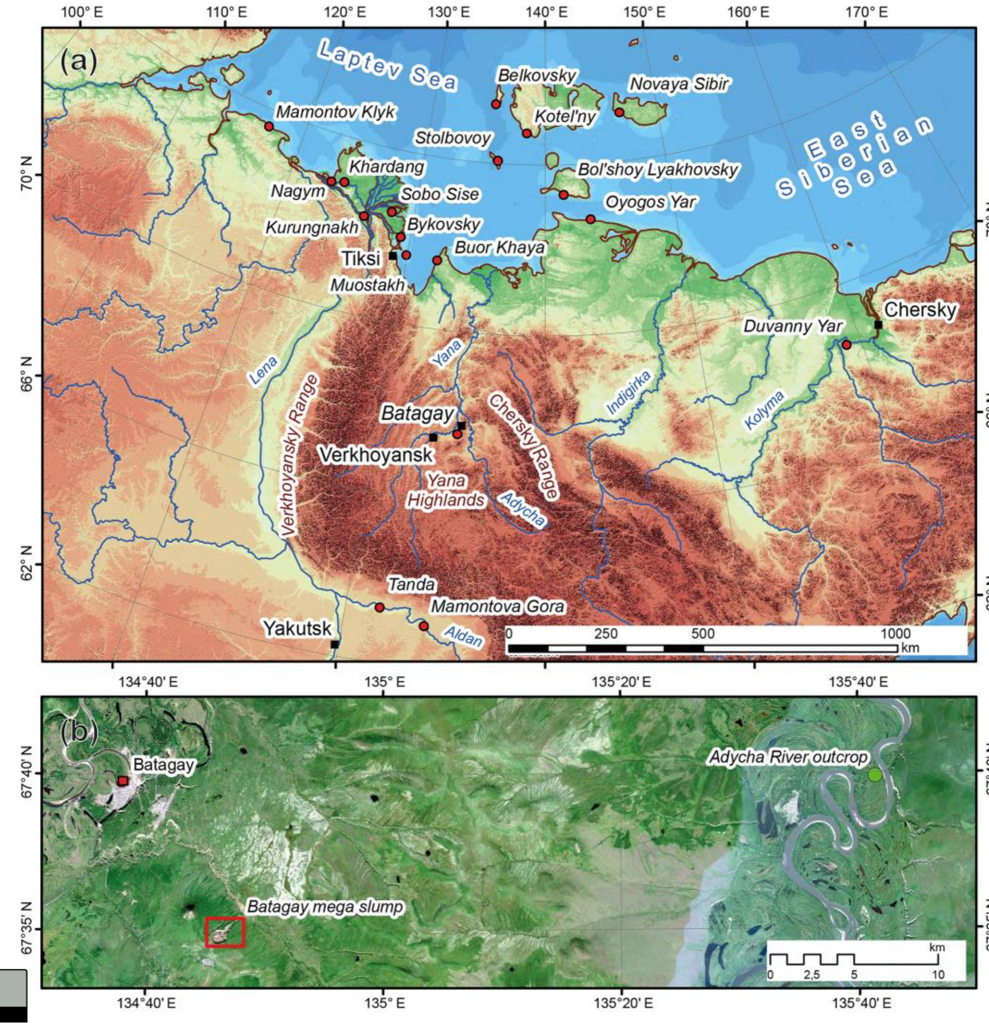
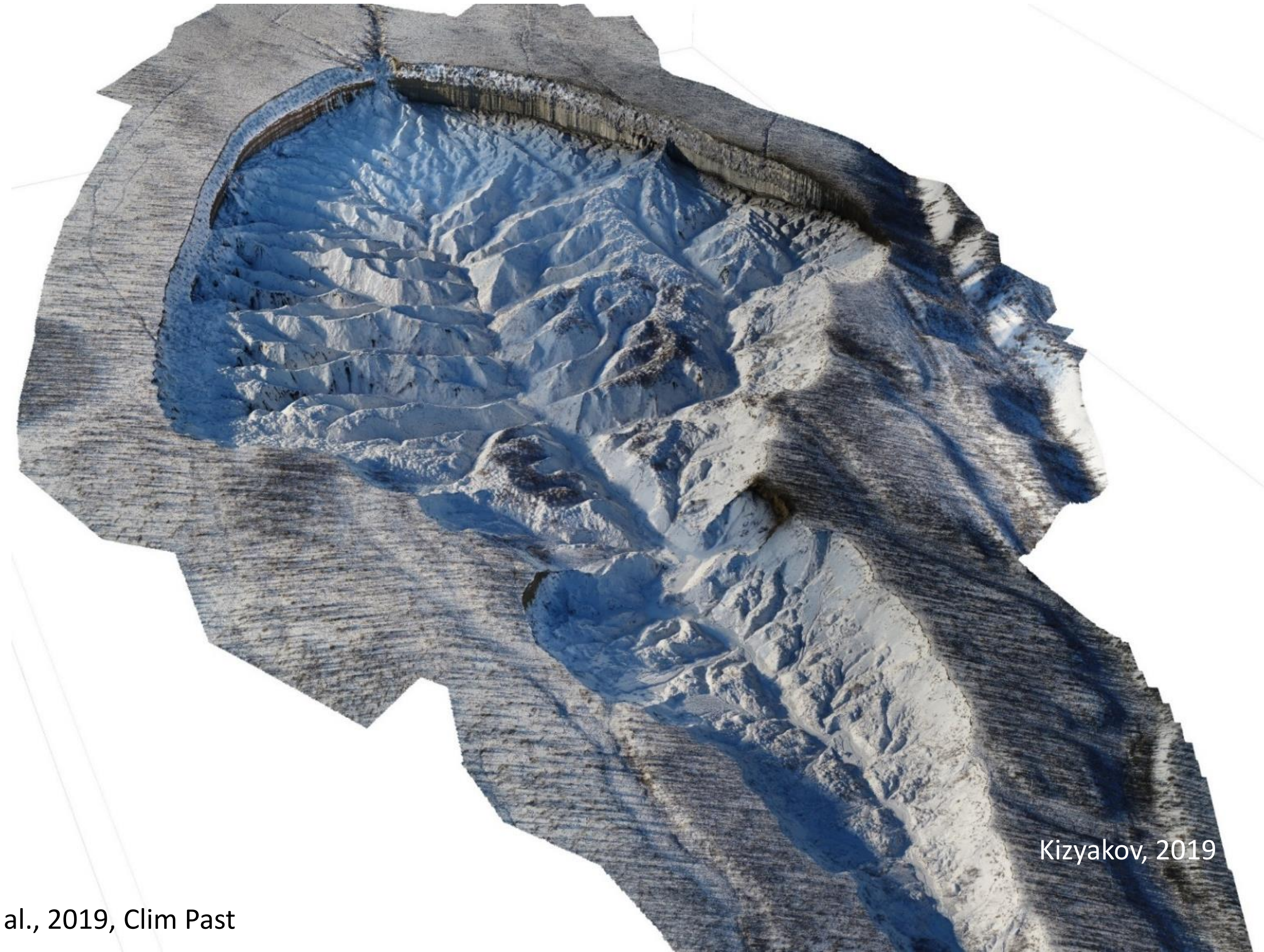
The world‘s largest retrogressive thaw slump in the most continental region of the Northern Hemisphere

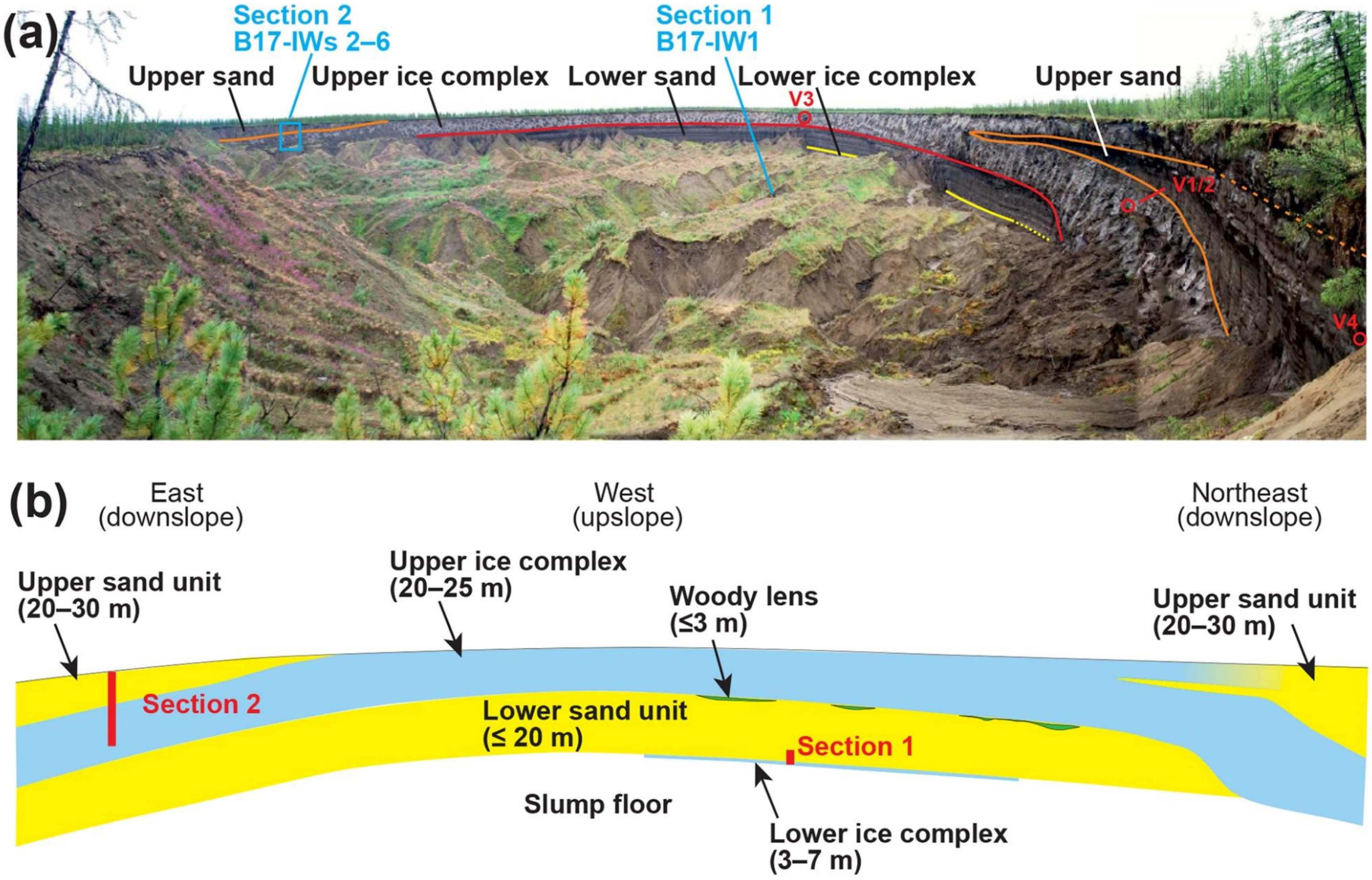


Opel et al., 2019, Clim Past



Kizyakov, 2019

Stratigraphy and chronology



Opel et al., 2019, ClimPast

Chronology based on radiocarbon, luminescence and $^{36}Cl/Cl$ dating

Cover → Holocene

Upper sand → MIS 3-2

Upper Ice Complex → MIS 4 -2

Woody debris → MIS 5 (?)

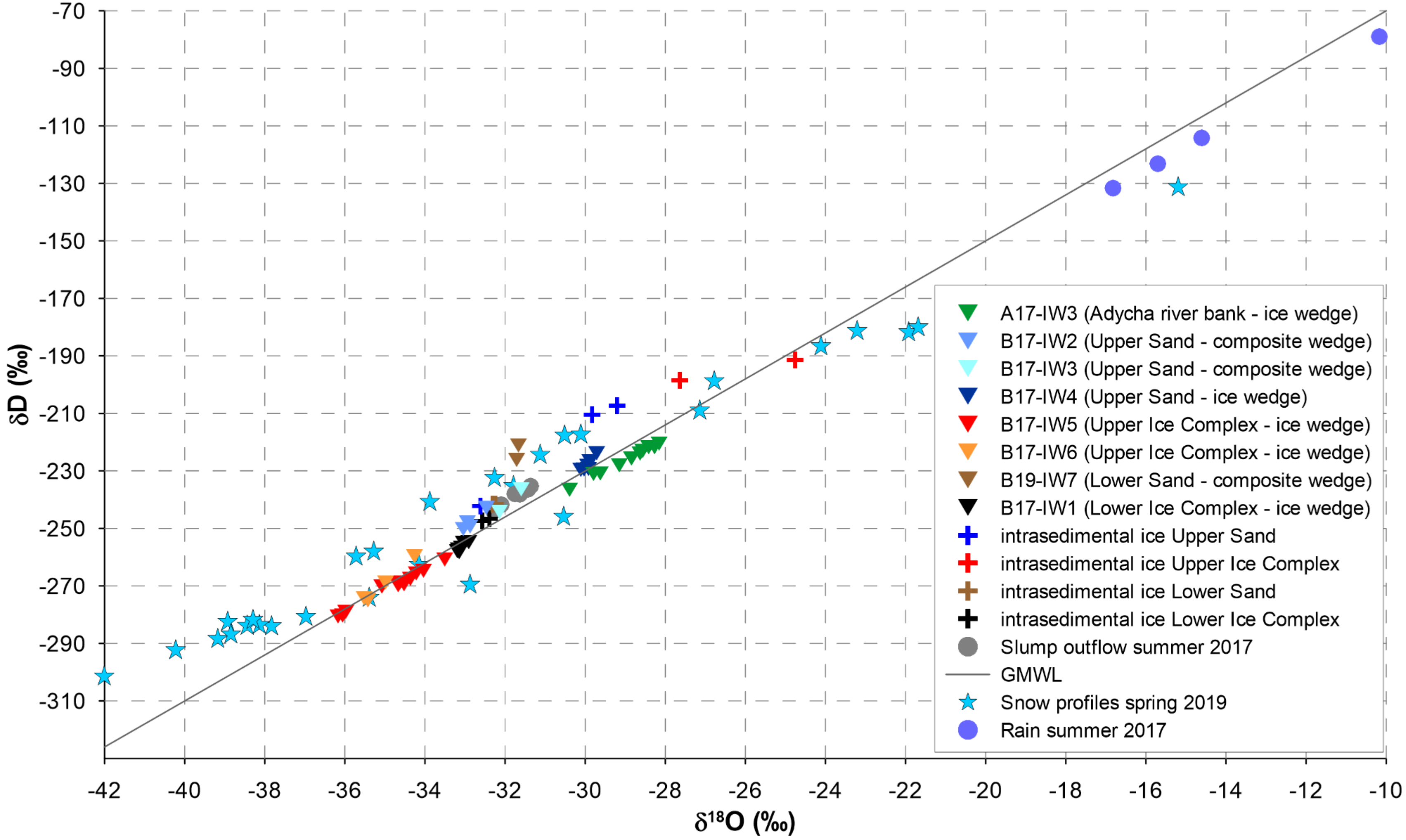
Lower sand → MIS 6

Lower Ice Complex → MIS 16

For details see Display D2672 by Wetterich et al. (Abstract EGU2020-2999, https://presentations.copernicus.org/EGU2020/EGU2020-2999_presentation.pdf)

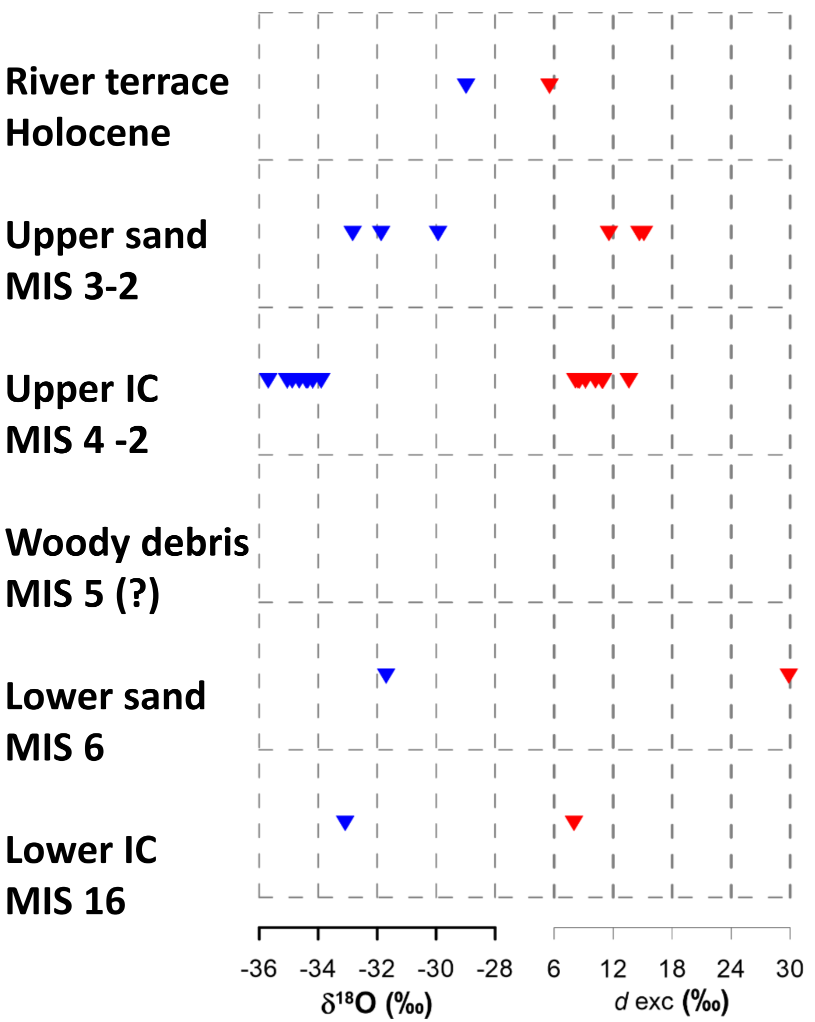
Ground ice stable isotopes Batagay Megaslump (and Adycha River)

Co-isotope plot of ground ice and precipitation



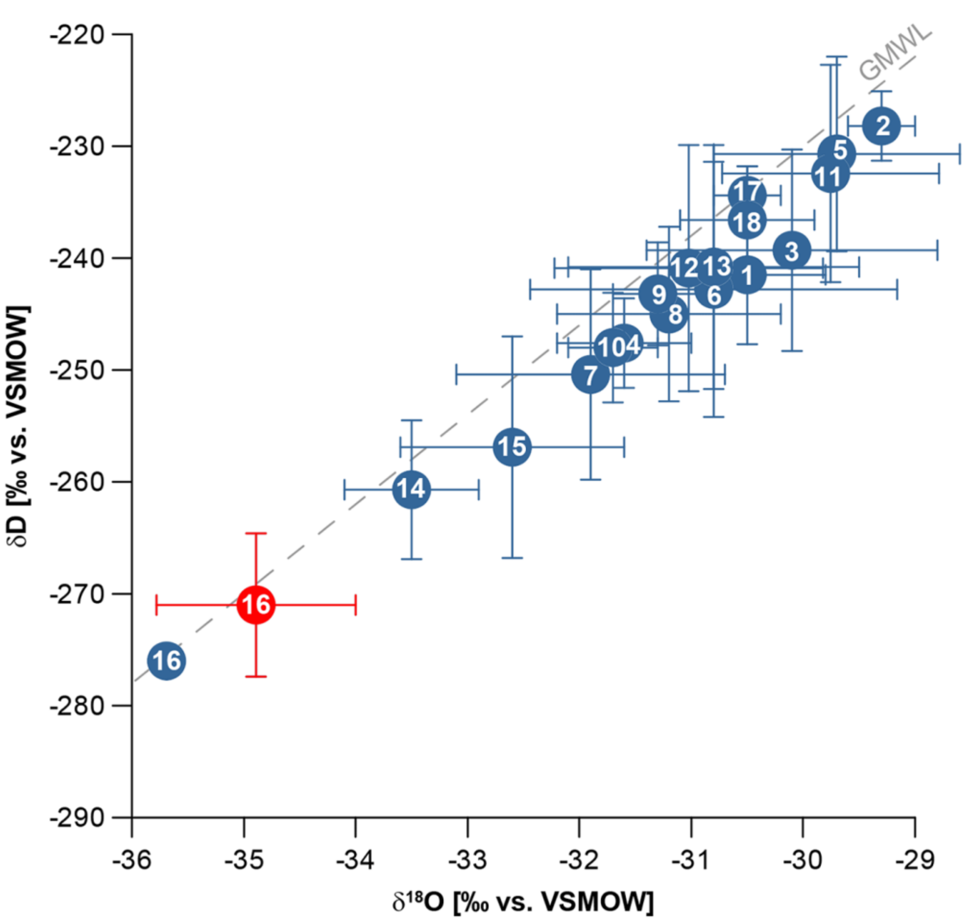
Opel et al., 2019, Clim Past, complemented

Mean ice wedge $\delta^{18}O$ and *d* exc data



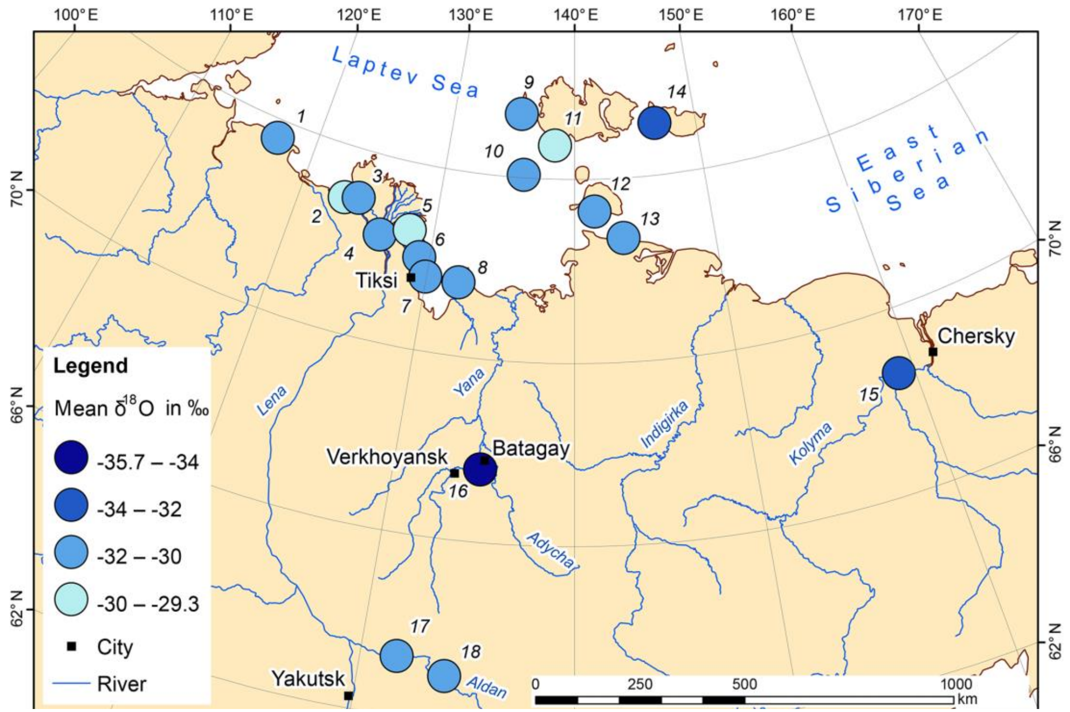
Data from Opel et al., 2019, Clim Past, Vasil'chuk&Vasil'chuk, 2019, Doklady Earth Sciences; Vasil'chuk et al., 2020, Doklady Earth Sciences; complemented

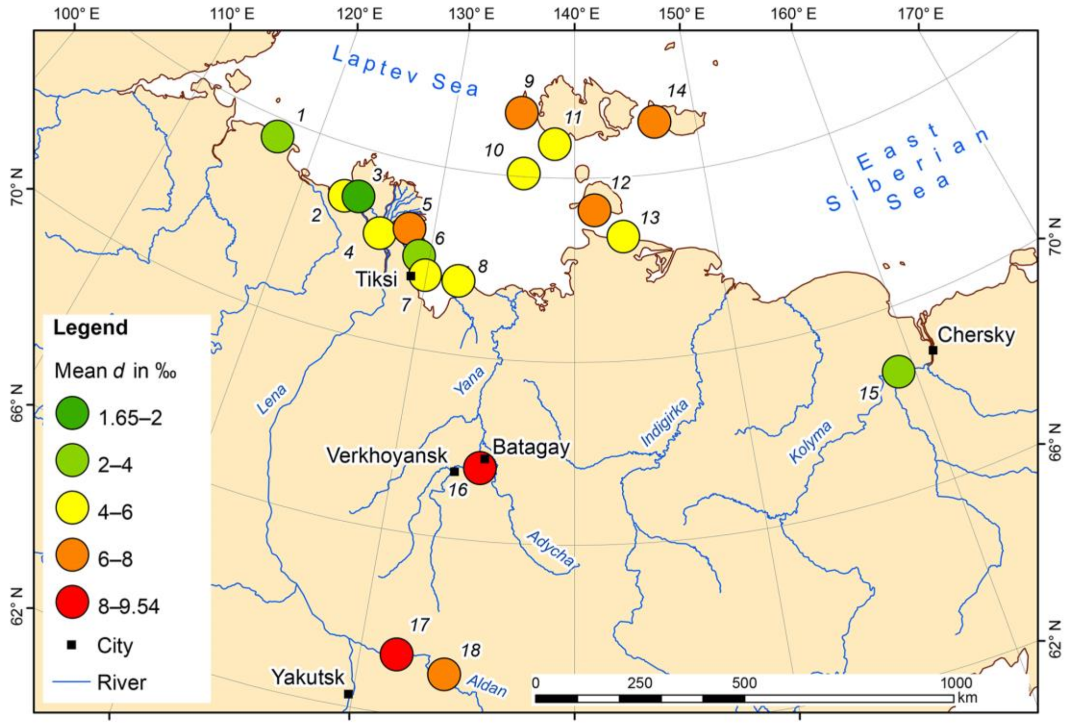
Spatial comparison of MIS 3 ice wedge $\delta^{18}O$ and *d* exc data



MIS 3 ice wedges

1 Western Laptev Sea, Mamontov Klyk
2 Lena Delta, Nagym
3 Lena Delta, Khardang
4 Lena Delta, Kurungnakh
5 Lena Delta, Sobo Sise
6 Central Laptev Sea, Bykovsky
7 Central Laptev Sea, Muostakh
8 Central Laptev Sea, Buor Khaya
9 New Siberian Islands, Belkovsky
10 New Siberian Islands, Stolbovoy
11 New Siberian Islands, Kotel'ny
12 New Siberian Islands, Bol'shoy Lyakhovsky
13 Dmitry Laptev Strait, Oyogos Yar
14 New Siberian Islands, Novaya Sibir
15 Lower Kolyma, Duvanny Yar
16 Yana Highlands, Batagay
17 Central Yakutia, Tanda
18 Central Yakutia, Mamontova Gora



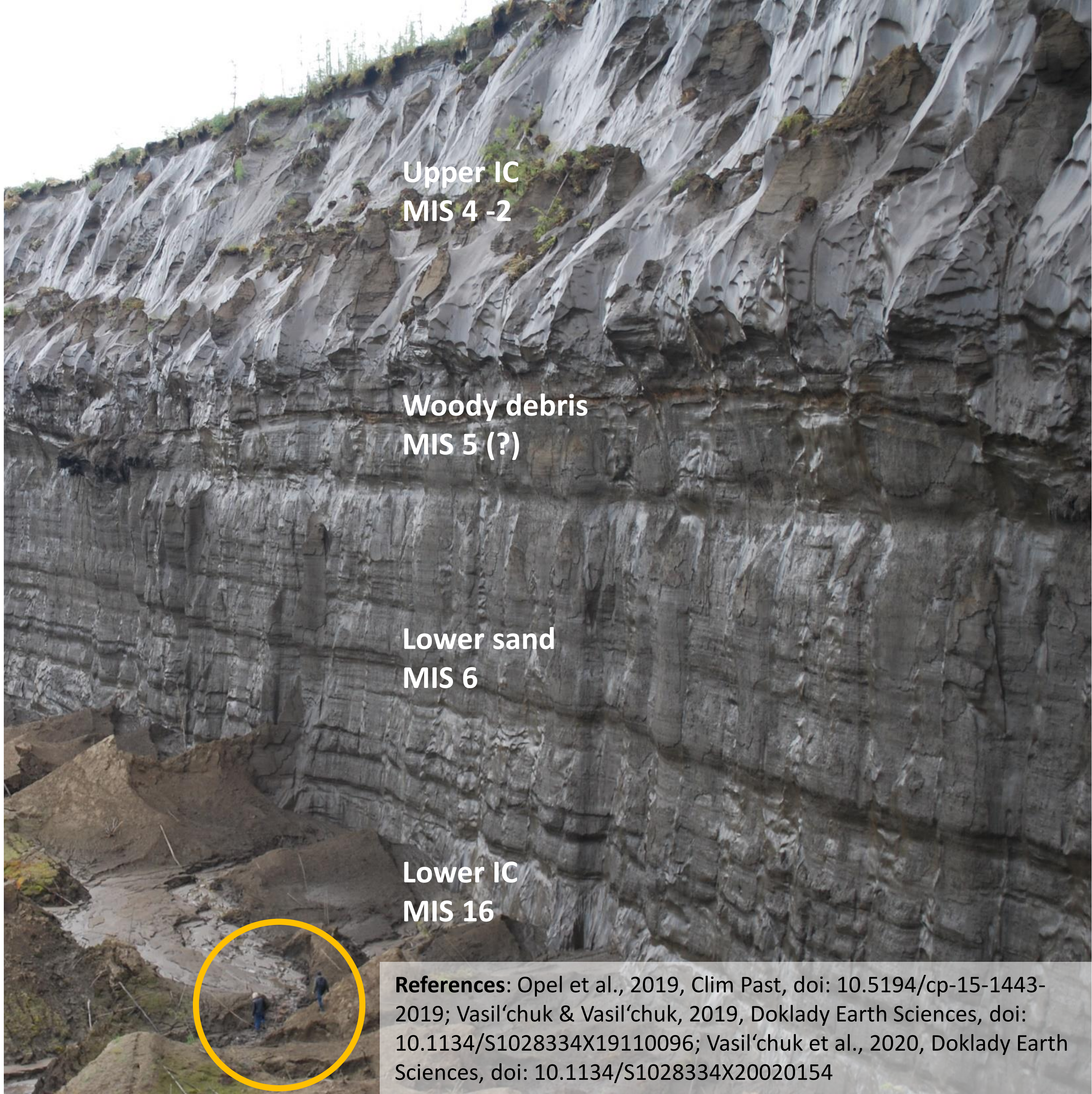


- Batagay ice wedge $\delta^{18}O$ data show coldest winters in Siberia
- Increased continentality accompanied by higher *d* exc values

Opel et al., 2019, ClimPast

Conclusions and outlook

- **The Batagay megaslump provides unique access to Late and Middle Pleistocene permafrost formations usually deeply buried in the frozen ground.**
- **The ice wedges from the Lower Ice Complex formed during MIS 16 and are the oldest ice wedges (~650 ka) ever analyzed isotopically.**
- **The high continentality with extremely low winter temperatures is clearly reflected by the stable-isotope composition for ice wedges from the Upper Ice Complex (MIS 3) which are much more depleted than for any other ice-wedge study site in East Siberia.**
- **Stable-isotope signatures of composite wedges and pore ice are less distinctive and require detailed studies of formation processes and seasonality.**



References: Opel et al., 2019, Clim Past, doi: 10.5194/cp-15-1443-2019; Vasil‘chuk & Vasil‘chuk, 2019, Doklady Earth Sciences, doi: 10.1134/S1028334X19110096; Vasil‘chuk et al., 2020, Doklady Earth Sciences, doi: 10.1134/S1028334X20020154