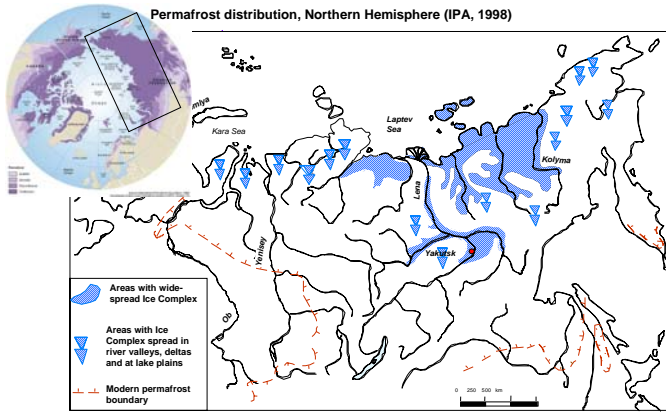


# CARBON DATA AND ORGANIC MATTER CHARACTERISTICS FROM ICE-RICH PERMAFROST-SITES (YEDOMA) IN NORTHERN EAST SIBERIA

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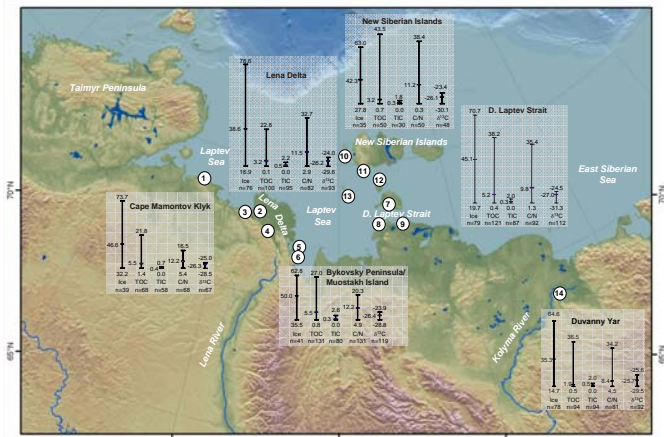
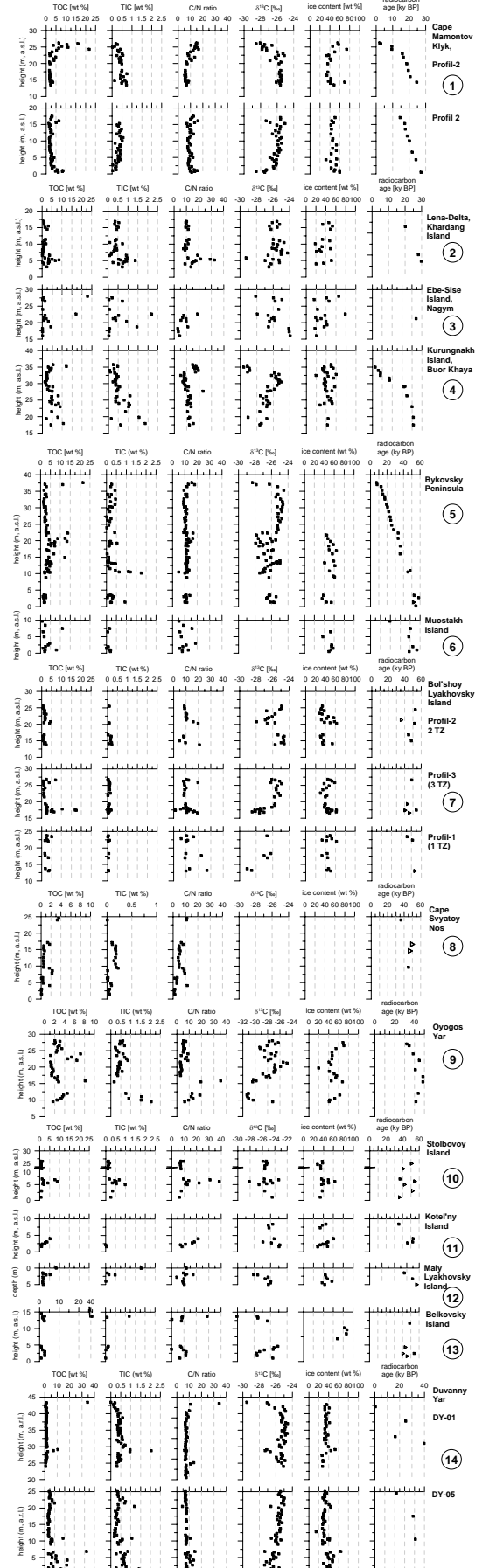
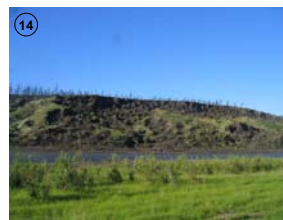
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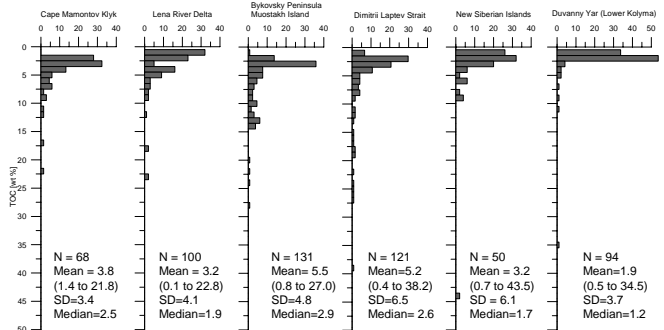


Areas of frequent Ice Complex distribution in the Russian Arctic and Subarctic (~ 1 million km<sup>2</sup>, Zimov et al., 2006); map compiled by C. Siegert, according to N.N. Romanovskii (1993)

- Ice-rich permafrost sequences (Ice Complex) are a large carbon pool sensitive to global warming
- Ice Complex deposits in Yakutia have been studied as a Late Pleistocene palaeo-environmental archive by joint German- Russian projects for more than 10 years
- Carbon characteristics (TOC, TIC, C/N,  $\delta^{13}C$ ) are used as proxy parameters for palaeo-environmental reconstructions
- Variations in TOC, C/N, and  $\delta^{13}C$  values reflect changes in bioproductivity, vegetation, pedogenesis, and organic matter decomposition
- $\delta^{13}C$  values indicating terrestrial freshwater and sub-aerial environment with dominating terrestrial C3 plants within the organic matter
- High TOC and C/N values combined with low  $\delta^{13}C$  values reflect less-decomposed organic matter preserved under anaerobic conditions, which is characteristic of Middle Weichselian interstadial periods
- Less variable low TOC and C/N values indicate stable environments with reduced bioproductivity, and high  $\delta^{13}C$  values reflect relatively dry, aerobic conditions during glacial and stadial periods



Study sites and variation of ice and carbon data (ice content, TOC, TIC [wt%]; C/N ratio;  $\delta^{13}C$  [‰])



Frequency distribution and basic statistic parameters of the TOC content (wt%) in Ice Complex deposits in various Yedoma areas

Sediment	Poorly sorted, organic-rich silty sand
Organic matter	Peat inclusions, twigs, grass roots, fine plant detritus
Cryolithology	Ice-supersaturated, syngenetic ice wedges, segregation ice
Formation age	80 to 12 ky BP; MIS-4 to MIS-2 (Early to Late Weichselian period)
Palaeoecology	Tundra Steppe/Mammoth Steppe
Climate	Highly continental, arid
Genesis	Nival lithogenesis, alluvial, proluvial, and aeolian accumulation
Landscape	Lowland plains and cryoplanation terraces in proximity to bedrock mountainous elevations
Terminology	Ice Complex deposits compose the Late Pleistocene Yedoma Suite, which is preserved in Yedoma hills
Thickness	10 to 50 m
Ice contents	Ice wedges: about 50 vol % (estimated) Segregation ice: 42±11 wt % (15 to 80 wt %; saturated to supersaturated)
Carbon	<ul style="list-style-type: none"> <li>• TOC (wt %): mean=4.0 (0.1-43.5); median=2.3; modal=2.0; SD=5.1, n=565</li> <li>• TIC (wt %): mean=0.4 (0-2.6); median=0.3; modal=0.4; SD=0.4, n=445</li> <li>• C/N ratio: mean=10.6 (0-38.4); median=9.9; modal=11.3; SD=4.8; n=505</li> <li>• <math>\delta^{13}C</math> (‰): mean= -25.9; (-31.3 to -23.4); median= -26.1; modal= -25.9; SD=1.3; n=552</li> </ul>

Compilation of characteristic features, measured data and geological background information for ice-rich permafrost sequences (Ice Complex) of the Siberian Arctic

Estimations of future greenhouse gas release from degrading Ice Complex deposits should carefully consider:

- Spatial distribution of Ice Complex in Arctic lowlands is only approximately known
- Arctic lowlands are dominated by thermokarst basins; only remnants of Yedoma hills are preserved
- The carbon distribution is highly variable in Ice Complex sequences
- Ice-rich permafrost contains up to 80 % of ground ice