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Paleoenvironmental dynamics of Western Beringia - New studies from the Yedoma key site Duvanny Yar (Lower Kolyma River, Siberia)

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Duvanny Yar is a stratigraphic key site for the late Quaternary in Western Beringia. It is characteristic for ice-rich permafrost sequences of the so-called Yedoma Suite in north-east Siberia (e.g. KAPLINA et al. 1978; SHER et al. 1979) and is an important reference site for the late Pleistocene history of Beringia (HOPKINS 1982). The aim of our study was to reconstruct the paleoenvironmental dynamics at the Duvanny Yar site during the late Quaternary using its terrestrial archive. A multidisciplinary approach using geocryological, geochronological, sedimentological, hydrochemical, isotope geochemical, and paleoecological methods was applied to obtain multiproxy records. Sediment samples were analysed for ice contents, grain size parameters, biogeochemistry (total carbon, total organic carbon, total nitrogen, stable carbon isotopes), mineral density, mass specific magnetic susceptibility, and for radiocarbon age. Stable isotopes of water were measured for ground ice (ice wedges, segregated ice, and pore ice), modern surface waters and modern precipitation.
Six profiles along the riverbank were sampled in August 2008. They contained Eemian lacustrine deposits, long sequences of Ice Complex deposits of the Late Pleistocene Yedoma, Holocene lacustrine and boggy deposits in thermokarst depressions. All profiles showed very bad sorted sediment of fine to coarse silt. A homogenous and polymodal grain size distribution for the ice rich ($\sim$30 to 60 wt %) Yedoma Suite revealed a polygenetic origin and disproves the pure “arctic loess” hypothesis for these deposits. Measurements of bulk density, ice content and total organic carbon content (TOC) enable for a relative TOC content in Ice Complex deposits at Duvanny Yar. The mean value of organic carbon at Duvanny Yar is 16 $\pm$ 11 kg/mˆ3. Geochronological results based on 11 new AMS ages revealed that the Yedoma Suite was continuously formed from the end of the Middle Weichselian ($\sim$ 40000 years BP) and at least until the Late Glacial Maximum ($\sim$ 20000 years BP). Stable water isotopes measured in ice wedges, segregated ice and ice lenses were used to estimate paleotemperature changes. Isotopic signals revealed cold temperatures for the whole period with relative warm peaks in the Eemian and Holocene times. During Yedoma Suite formation the climate was stable and cold. A better understanding of the paleoenvironmental dynamics at Duvanny Yar may provide a basis for more reliable predictions of future reaction on global warming of organic-bearing ice-rich permafrost in Siberia which is considered as a potential greenhouse gas source permafrost (DUTTA et al. 2006; ZIMOV et al. 2006).

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