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A 240 ka terrestrial 18O record from a NE-Siberian loess-like permafrost paleosol-sequence based on a novel analytical 18O method

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Recently, we developed a novel analytical tool for paleoclimate research based on compound-specific delta18O analyses of hemicellulose-derived monosaccharides using gas chromatography-pyrolysis-isotope ratio mass spectrometry (GC-Py-IRMS) (Zech and Glaser, 2009. Rapid Communications in Mass Spectrometry 23, 3522-3532). This method overcomes extraction, purification and hygroscopicity problems of so far applied cellulose methods based on TC/EA-IRMS delta18O analyses and allows establishing 18O records from sedimentary organic matter. Taking advantage of plant samples from a climate chamber experiment we can demonstrate that our novel method yields similar results like cellulose for plant material. Furthermore, we demonstrate using 18O-enriched water that the hydroxyl-groups of hemicelluloses are not prone to oxygen exchange reactions (Zech et al., 2012. Organic Geochemistry 42, 1470-1475). Ongoing methodological improvements will be shortly reported.
By applying our novel 18O method to a loess-like permafrost paleosol-sequence we established a presumably 240 ka terrestrial 18O record for NE-Siberia. While the modern topsoil and the interglacial/-stadial paleosols reveal more positive delta18O values, the glacial paleosols reveal more negative delta18O values. The 18O variability is generally confirmed by a respective deltaD record which is based on sedimentary plant leafwax-derived n-alkanes. This finding suggests that our high-latitude 240 ka terrestrial 18O and D/H record from NE-Siberia reflects the temperature-dependent isotopic composition of precipitation and the increased isotopic enrichment of leaf-water during interglacials/-stadials.