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## Thema
Kommission II: Bodenchemie

Freie Themen

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## Titel
Stable hydrogen isotope ratios in crystal water of clay minerals

## Abstract
Hydrogen is the most abundant element in the Universe. But the utilization of the H isotopic composition (?H-2 value) of soil to elucidate biogeochemical processes or to serve as a palaeo climate proxy is still in its infancy. In our research, we will focus on the ?H-2 value of nonexchangeable H in the clay fraction of soils. The ?H-2 value of structural H in clay minerals – mainly from C-poor subsoils - has been studied since the 1970s. The ?H-2 value of clay minerals mainly depends on (a) the average ?H-2 value of ambient water at the site and time of formation, and on (b) the size of the equilibrium isotopic fractionation factor between water and clay mineral at the temperature of formation. In our research, we will focus on the ?H-2 value of nonexchangeable H in the clay fraction of soils. Only nonexchangeable H in in structural water of minerals preserves its inherited ?H-2 value and does not exchange with water at temperatures usually occurring in soil environments at the Earth's surface. Nonexchangeable H is bound in crystal water, which integrates the ?H-2 value of soil water over several millennia. This is in turn determined by palaeoclimatic variations of the precipitation's ?H-2 signal with distinguishable shifts e.g., from Pleistocene to Holocene. For a global data set, Ruppenthal (2014) reported a close correlation of bulk soil ?H-2 values with those of the mean local precipitation and confirmed this for organic matter, while the clay fraction of soils was up to now not studied. We will adapt a steam equilibration method with water vapor of known H isotopic composition – formerly applied by Ruppenthal (2014) on SOM and bulk soil – to clay fractions and compare our results to the hitherto used heating treatments (200-250°C) under vacuum. We expect that the ?H-2 signal of the clay fraction of Bt horizons will serve to differentiate soils developed in different climatic epochs (e.g., Holocene, last interstadial, last interglacial) by analyzing dated palaeo soil samples. To test the hypothesis that there is a similar global regression line of the ?H-2 values in structural water of clay as up to now reported for bulk soils and soil organic matter, we will analyze the clay fraction in a global set of soil samples.

Literatur
Ruppenthal, Marc. 2014. Stable Isotope Ratios of Nonexchangeable Hydrogen in Bulk Organic Matter as Novel Biogeochemical Tracer. PhD Thesis, Tübingen: University of Tübingen.