Geophysical Research Abstracts
Vol. 20, EGU2018-3566, 2018
EGU General Assembly 2018

The Nesseltalgraben paleolake (southeastern Germany) - an Alpine archive of climatic variability during MIS 3

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In the northern Alps, only a few lacustrine sediment sequences cover the Last Glacial period, regionally termed Würmian. Recently discovered outcrops at the Nesseltalgraben site in southeastern Germany comprise more than 25 m of predominantly lacustrine sediments capped by glaciofluvial sediments of the Last Glacial Maximum. Radiocarbon analyses provided ages between 26.5 and >51.5 ^{14}C ka BP, making the site an important archive of Marine Isotope Stage (MIS) 3 in the northern Alps.

An unconformity in the lower part of the outcrops is dated to 47 ^{14}C ka BP. It separates a diamictic layer, preliminary interpreted as an erosive debris flow, from the overlying lacustrine strata. Layers immediately below the diamict are palynostratigraphically attributed to the Lower Würmian. The Middle Würmian record (approximately equivalent to MIS 3) above the diamict consists mainly of organic-rich muds, intercalated by carbonate muds, compressed peat, and clastic layers. The most probable driving forces for these variations in the depositional environment are climatic fluctuations known as Greenland stadials and interstadials from ice cores. High-resolution XRF scanning data reveal characteristic fluctuations of several chemical elements, pointing to rapidly changing environmental conditions in accordance with the observed lithological changes. Ca/Ti ratios exhibit highest values in carbonate muds and lowest in organic-rich layers, while Rb/Sr shows the opposite patterns. We hypothesize that layers rich in Rb, K, Si, Ti, and organic matter represent interstadial conditions, while Ca-rich and organic-poor layers were deposited during stadials. Peaks of P and S are related to specific organic-rich layers and represent special interstadial depositional conditions.

Ongoing research in the DFG-project ALPWÜRM will provide a more detailed palaeontological (pollen, ostracodes, macrofossils), geochemical, isotopic, and sedimentological basis for reconstruction of the climatic conditions during MIS 3 in the Alps and how they affected the Alpine environment.