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Influence of HCl pretreatment on laser diffraction measurements

Philipp Schulte (1), Florian Steininger (2), Gregori Lockot (3), Frank Lehmkuhl (1), Georg Stauch (1), Jens Protze (1), and Peter Fischer (4)

(1) Department of Geography, RWTH Aachen University, Templergraben 55, D-52056 Aachen, (2) Institute of Geography, University of Cologne, Albertus-Magnus-Platz, D-50923 Cologne, (3) Institute of Geographical Sciences, Freie Universität Berlin, Malteserstr. 74-100, D-12249 Berlin, (4) Institute for Geography, Johannes Gutenberg-University Mainz, Johann-Joachim-Becher-Weg 21, D–55099 Mainz

Sample pretreatment methods in grain size (GS) analyses differ and their influence on GS distributions has been subject of controversial discussions. The standard sample preparation usually comprises the disaggregation into single primary particles. The organic binding material is oxidized by hydrogen peroxide (H_2O_2) and the containing carbonates are dissolved by hydrochloric acid (HCl). However, laser diffraction measurements of calcified sediment sequences or sediments with high contents of organic matter show non-reproducible changes in the GS distribution.

To investigate variations of the GS distribution, selected samples from two different sections in different stages of weathering and sedimentary genesis were measured using a Beckman Coulter LS13320 laser particle size analyser. A high-resolution Holocene sandy loess-paleosol sequence, the Suohuduo section on the eastern margin of the Tibetan Plateau, was investigated. The results were compared with a Pleistocene loess sequence from the Lower Rhine Embayment, the Düsseldorf-Grafenberg section. The entire sample set includes samples of siliciclastic, barely weathered material and sediments from paleosols. The paleosols in the Suohudo section are strongly influenced by steppe fires and are rich in organo-mineral associations and pyrogenic carbon.

All samples were pretreated with hydrogen peroxide and sodium pyrophosphate. In order to investigate the influence of HCl on the GS distribution, the samples were subsequently prepared with and without the addition of HCl.

The results show that the sample preparation has a significant influence on the detected GS distribution. Hence, prior to the measurement of a sample set, the effectiveness of the pretreatment argents HCl and H_2O_2 should be evaluated. In order to generate a valid GS distribution, the sample pretreatment must be matched to the aim of the study and the composition of the sample. Paleoclimatic and environmental interpretation based on improper GS results due to sample handling and pretreatment may be misleading.