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Extending and simplifying the standard Köhn-pipette technique for grain size analysis

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Grain size distribution is a fundamental parameter to characterize physical properties of soils and sediments. Manifold approaches exist and according to the DIN ISO 11277 soil texture is analyzed by default with the combined pipette sieving and sedimentation method developed by Köhn. With this standard technique subfractions of sand and silt as well as the total clay content can be determined but the differentiation of clay subfractions is impossible. As the differentiation of the clay subfractions yields relevant information about pedogenesis, we present a protocol basing on standard techniques of granulometry with easy to handle and low cost equipment. The protocol was tested on a set of soil samples to cover the range of grain size distributions.
We used a three-step procedure for achieving the grain size distribution of soil samples taking into account the subfractions of sand, silt and clay by a combination of sedimentation, centrifugal sedimentation and wet sieving. The pipetting was done with a piston-stroke pipette instead of the referred complex pipette from the DIN ISO 11277.
Our first results show that the applied protocol is less prone to operating errors than the standard Köhn-pipette technique. Furthermore, even a less experienced laboratory worker can handle 10 samples in one day. Analyses of a luvisol profile, sampled in high spatial resolution, showed that the lessivation process is characterized by translocation of fine clay from the eluvial horizon to the illuvial horizon. Therefore our protocol is a fast alternative to detect lessivation, which is otherwise only clearly identifiable by micromorphological investigation and not by the standard Köhn-pipette technique.