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## Titel
Particle size as controlling factor of soil microaggregate formation

## Abstract
Aggregates are formed when soil particles connect to larger secondary units. Stable microaggregates in soils are supposed to consist of close associations of Fe-oxides and clay minerals with both components being attracted by electrostatic forces between the oppositely charged particles. However, the geometric preconditions for the formation of stable associations between Fe oxides and clay minerals are poorly known. Therefore, our goal was to determine geometrical constraints resulting from particle size and morphology likely impeding optimum arrangement of particles for shielding of charges during aggregate formation. Aggregation kinetics was determined for nine combinations of each three particle size fractions of goethite and mica in a Zetasizer at pH 6. Experiments were conducted using needle-shape goethites synthesized at 4, 20, and 60°C (lengths of 0.42, 0.46 and 0.84 µm, specific surface areas (SSA) of 87, 75, and 60 m²/g, respectively) and ground platy muscovite separated in fine, medium and coarse clay (diameters of 0.16, 0.80, and 2.9 µm, SSA of 182, 100, and 27 m²/g, respectively). For five combinations even smallest additions of goethite to muscovite facilitated aggregation. By further additions of goethite maximum aggregate sizes up to 5.6 µm were obtained, the respective mixing ratio strongly depending on the type of combination. After that sizes declined. For medium and coarse-sized muscovite, goethite amendments >18% did not facilitate aggregation, indicating the dominance of repulsive forces. In contrast, for fine-sized muscovite aggregation was facilitated up to an addition of 63% fine-sized goethite and of 90% coarse-sized goethite. Here also biggest aggregate sizes were obtained. Based on all examined size fraction combinations, our results suggest a strong impact of particle size on aggregation. Whereas all combinations with fine-sized muscovite facilitated aggregation at very different mixing ratios, the amendment of the finest fraction of goethite to medium- and coarse-sized muscovite facilitated aggregation at small additions only. Aggregation was favored for evenly sized combinations. The quantification of surface charge density of minerals and calculation of charge balances of the combinations is in progress and will help interpreting the observed aggregation patterns. For soils it is likely that aggregation by electrostatic interactions occurs only at certain mineral mixing ratios highly depending on particle morphology.