



Initial microaggregate formation: association of microorganisms to montmorillonite-goethite aggregates under wetting and drying cycles

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Abiotic and biotic factors are influencing the initial formation of soil microaggregates, which also serve as favorable habitat for microorganisms. The dynamic process of aggregate formation and degradation as well as microbial colonization and survival are linked, but little is known about the initial aggregate formation phase and the role of microorganisms during this process under the impact of environmental stress conditions like rain and drought periods. We investigated the initial aggregation process for the model minerals montmorillonite and goethite in presence of two soil bacterial strains subjected to wetting and drying cycles. Analysis of images taken from a microparticle detector showed that the size of newly formed aggregates in presence of microorganisms was strain dependent and up to twofold larger. Especially during drying periods, larger microaggregates had a sheltering effect harboring living bacterial cells, as was shown by epifluorescence microscopy. An enhanced capability of EPS production increased survival rates, but did not influence aggregate development. The aggregate formation process can be characterized by a rapid occlusion of mineral compounds; microorganisms colonize small microaggregates, therewith supporting an increase in aggregate size. Further development of the aggregate size distribution depends on the presence of individual microbial species and is also modulated by environmental changes like desiccation.