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Chemie der Verwitterung und Bodenbildung

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Titel
Initial development of soil structure and soil organic matter in an agriculturally managed chronosequence on recultivated loess

Abstract
Soil structure and soil organic matter (SOM) are closely connected characteristics of a soil material. Their interactions affect various physical, chemical and biological soil properties like water holding capacity, carbon stabilization and microbial habitat. The intertwined development of soil structure and quality and quantity of SOM during soil formation are not clear until now. We used a chronosequence approach in the recultivated open-cast mining area near Cologne, Germany to elucidate the development of soil structure and soil organic matter during initial soil formation in a loess material. We selected six plots with different ages of agricultural management after recultivation (0, 1, 3, 6, 12, and 24 years after first seeding). In each plot 12 spatially independent locations were sampled with stainless steel cylinders (100 cm^3) at three depths representing the topsoil (1-5 cm), the plough layer (16-20 cm), and the management-unaffected parent material (41-45 cm). All samples were analysed for bulk density, organic and inorganic carbon and nitrogen content, and aggregate size distribution. We evaluated the development of aggregation and soil organic matter stocks during this early phase of soil formation. This system is temporarily highly dynamic and shows different developments for bulk density, SOM and aggregate formation. In just one year bulk density increased to an average of 1.6 g/cm^3 and remained stable for the next three years. After agricultural management with ploughing and cultivation from the 6 years, all sites showed bulk density decrease, which remained stable from topsoil to parent material after 12 years with average bulk density 1,5 g/cm^3. Soil carbon content increased during the chronosequence and showed highest variability from 2,3 mgC/g to 18,7 mgC/g in the 3 years old field, which shows the beginning of the interaction between soil and biota, and carbon input.