Svenja Roosch, Vincent Felde, Daniel Uteau, and Stephan Peth
Kassel University, Department of Soil Science, Witzenhausen, Germany (felde@uni-kassel.de)

Soil microaggregates are considered to play an important role in soil functioning and soil organic carbon (SOC) is of great importance for the formation and stabilization of these aggregates. The loss of SOC can occur, for example, after a change in land use and may lead to a decreased aggregate stability, which makes soils vulnerable to various threats, such as erosion or compaction. It is therefore important to shed light on the effect of SOC loss on aggregate stability in order to better understand and preserve the functioning of healthy soils.

We sampled two adjacent plots from a loess soil in Selhausen (Germany) and measured aggregate stability and architecture of soil microaggregates. One plot was kept free from vegetation by the application of herbicides and by tillage (to a depth of 5 cm) from 2005 on (organic matter depletion, OMD), while the other plot was used for agriculture using conventional tillage (control). Over the course of 14 years, the SOC concentration in the bulk soil has been reduced from 12.2 to 10.1 g SOC kg⁻¹ soil. It was, however, unclear whether a loss of SOC had also taken place in microaggregates (since they are known to have very long turnover times). We took 10 undisturbed soil cores from two depths of each plot (Ap and Bt horizons).

The stability of aggregates against hydraulic and mechanical stresses was tested using wet sieving (mesh sizes of 0.25 to 8 mm) and a crushing test in a load frame adapted to the microaggregate scale. For the latter test, microaggregates were isolated from the bulk soil using a newly developed dry crushing approach. To shed light on the effect of a decreased SOC content on microaggregate structure, we scanned several microaggregates with a computed tomography scanner at sub-micron resolution and analysed the features of their pore systems. SOC losses had also occurred in large microaggregates (250-53 µm) in the Ap horizon: SOC contents in this fraction were 16.3 g SOC kg⁻¹ (control) and 12.8 g SOC kg⁻¹ (OMD). While wet sieving indicated a lower stability of macroaggregates from the Ap horizon in the OMD plot (geometric mean diameter: 1.54 mm (control) vs 0.43 mm (OMD)), an effect on the tensile strength of large microaggregates could not be found. Total porosity and pore connectivity, derived from Euler characteristic, as well as several pore skeleton traits (number of branches, junctions, etc.) were lower in aggregates from the OMD treatment. However, the difference was also present or even stronger in the Bt horizon than in the Ap horizon, so the supposed treatment effect might have been due to other effects like spatial heterogeneity of texture. Thus, the observed SOC losses may not have been large enough to
substantially influence structure or stability of large microaggregates.