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Advances in Atomic Force Microscopy allow investigation of nano-mechanical properties of soil aggregates

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Spatial variations at the nanoscale of soil aggregate surfaces and in the spatial organisation of soil organic matter (SOM) are critical to understanding the factors involved in soil composition and turnover. However, soil nanoscience has been hampered by the lack of suitable methods to determine soil biophysical properties at nanometre spatial resolution with minimal sample preparation.

Here we introduce an Atomic Force Microscopy (AFM)-based Quantitative Nano-Mechanical mapping (QNM) approach that allows the characterisation of the role of SOM in controlling surface nano-mechanical properties of soil aggregates. SOM coverage resulted in an increased roughness and surface variability of soil, as well as in decreased stiffness and adhesive properties. The latter also correlates with nano- to macro-wettability (hydrophobicity) features as determined by contact angle measurements and Water Drop Penetration Time (WDPT) testing. AFM thus represents an ideal quantitative tool to complement existing techniques within the emerging field of soil nanoscience.