Spectromicroscopy at the organo-mineral interface in soil

JOHANNES LEHMANN[1]*, ANGELA POSSINGER[1], BARNABY LEVIN[2], AKIO ENDERS[1], DAWIT SOLOMON[1], LENA KOURKOUTIS[2] AND DAVID MULLER[2]

[1]Soil and Crop Sciences, Cornell University, Ithaca NY 14853, USA

[2]School of Applied and Engineering Physics, Cornell University, Ithaca, NY 14853, USA

Soil organic matter stores several-fold more organic carbon than the atmosphere and biosphere combined. Small changes in soil organic matter will have significant effects on atmospheric carbon dioxide contents and therefore global climate. This is both a challenge when considering enhanced mineralization in a warming World, and an opportunity to sequester atmospheric carbon dioxide to mitigate anthropogenic climate change. Despite the importance of soil organic carbon in the global carbon cycles, the interactions between organic matter and minerals are not clear. This is a significant shortcoming, since without this interaction, organic matter will mineralize very quickly. X-ray microscopy can shed new light on this interaction, and NEXAFS has been instrumental in highlighting the distribution of carbon and minerals in soil. However, the spatial resolution of NEXAFS is with 20-50 nm still too low to probe the interface directly. EELS is theoretically able to image with 1-2 order greater spatial resolution but has rarely been used in soil science and not in the context of soil organic carbon studies. With the help of cryo-focused ion beam technology, we sectioned soil microaggregates that were embedded in shock-frozen water. Beam damage occurred when imaging pure amino acid standards. First analyses of the interface of cryo-sectioned soil microaggregates are discussed.