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1. Background

- Soil organic matter (SOM) is an essential component of healthy soil, the subsoil contains half of the SOM.
- It provides aggregation, structure, buffer capacity and acts as a nutrient source in the soil.
- SOM is transported to the soil mainly as plant residue and decomposed by the soil microbiota. The equilibrium between these input and output results in the actual SOM content.
- SOM migrates in the soil in a dissolved form, which is extremely vulnerable for decomposition
- Soil has the ability to sequester organic matter via inhibiting biological decomposition as two main processes.
- (1) Physical way: organic matter occluded by the aggregates (temporal shelter)
- (2) Chemical bounding to the mineral particles' surface: More stable, increased defence against microbial decomposition
- SOM of the topsoil is widely investigated, however our knowledge on subsoil organic matter stabilization is limited.

2. Aims

- To understand leaching dissolved organic matter binding preferences in the subsoil
- To identify the OM adsorption ability of various minerals typical in the subsoil layer.
- To survey the spatial distribution of organic matter coatings on the surface of the investigated soil minerals
- To analyze the chemical composition of organic matter adsorbed by the various mineral components.

3. Materials

- IUSS soil organic matter standards („Suwanne river” fulvic acid II.) were used as dissolved organic matter
- OM solution was created with 170 mg/L concentration
- Mineral standards (Goethite, Mica, Illite, Montmorillonite, and Quartz) were used as adsorbents.
- 1:20 suspension was created and shaken for 24 hours. After the adsorption the solid and the liquid phase were separated and investigated.

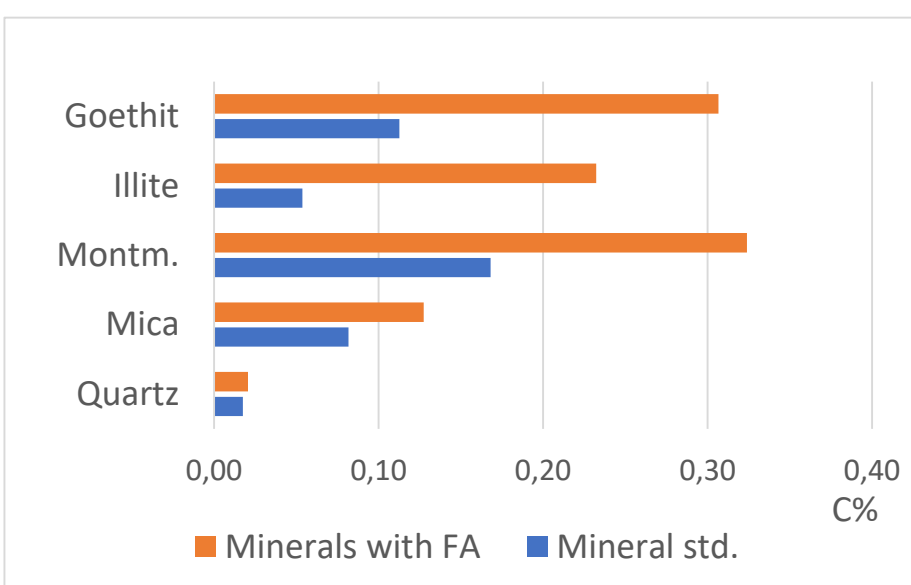
4. Methods

- The carbon content of the minerals before and after the adsorption were measured using Flash 2000 Organic Elemental Analyzer.
- Organic matter composition of the minerals before and after the adsorption was measured by Fourier Transform Infrared Spectroscopy
- Organic matter coatings on the mineral surfaces were measured and surveyed using Scanning Electron Microscopy
- Non adsorbed dissolved organic matter content were measured by High Performance Liquid Chromatography.

5. Results

• Mass spectrometry:

Preliminary results suggest the varying SOM binding capacity of the minerals in the quartz < mica < montmorillonite < illite < goethite order.

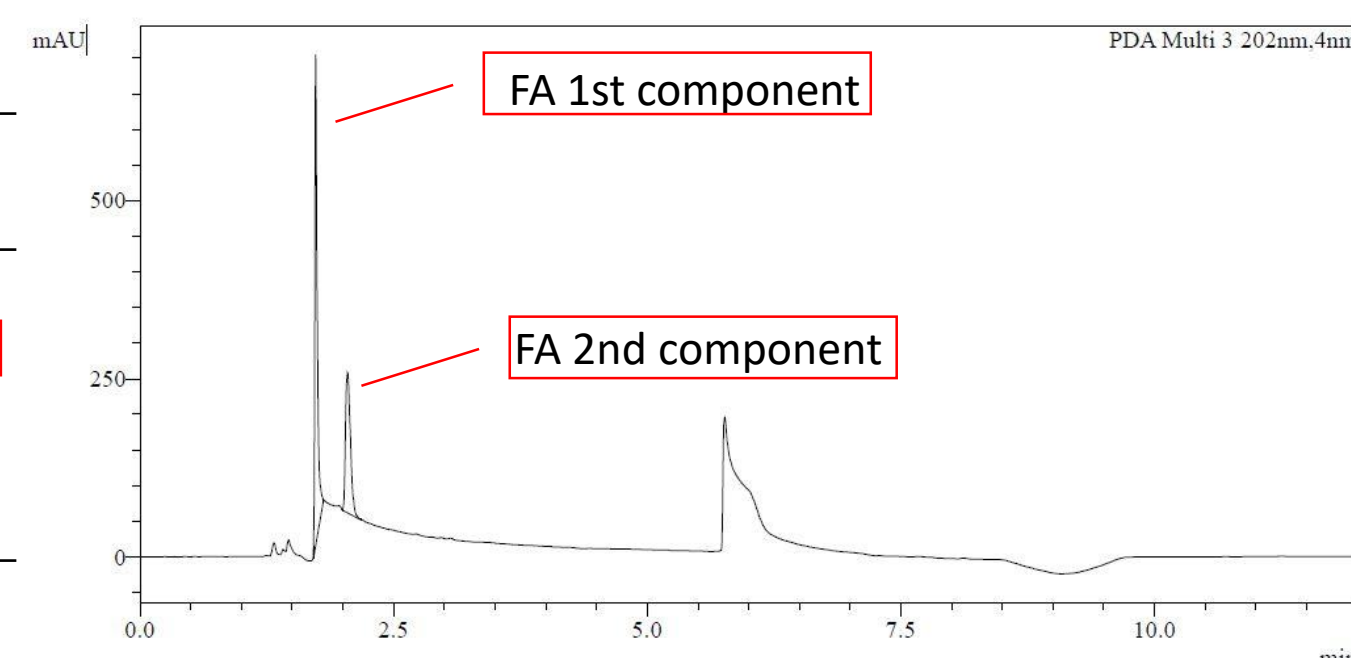


Goethite has the highest adsorption capacity for FA. HPLC measurements showed, that goethite may selectively adsorb the more hydrophilic component of the FA, while Illite and mica adsorb the less hydrophilic component.

• HPLC:

The HPLC results divide the FA standard into 2 characteristic groups based on hydrophobicity. Negative values were obtained, because water molecules were incorporated into the swelling clay mineral structure, making the solution more concentrate. Minerals may selectively adsorb FA1 and FA2 components.

	Adsorbed FA1 component (mg/g)	Adsorbed FA2 component (mg/g)
Goethite	2,9	0,0
Montmorillonite	-0,3	-0,6
Quartz	0,0	0,0
Illite	0,0	1,2
Mica	0,0	1,4



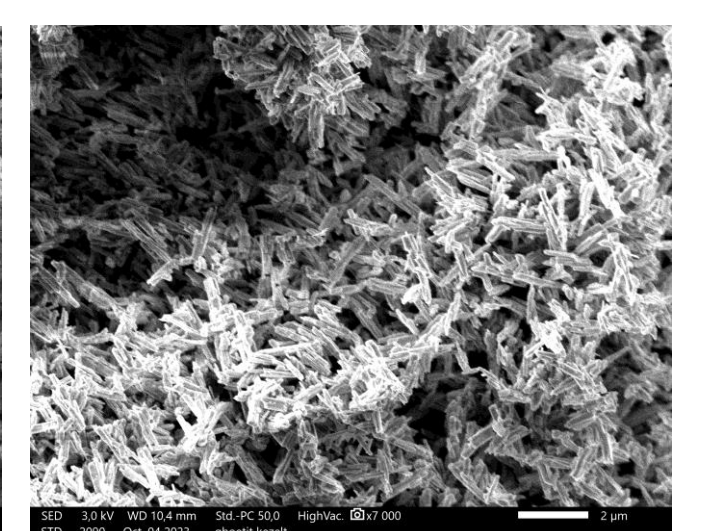
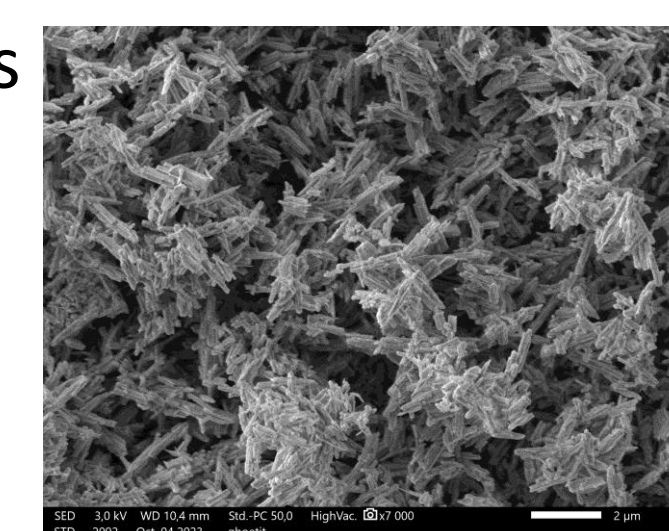
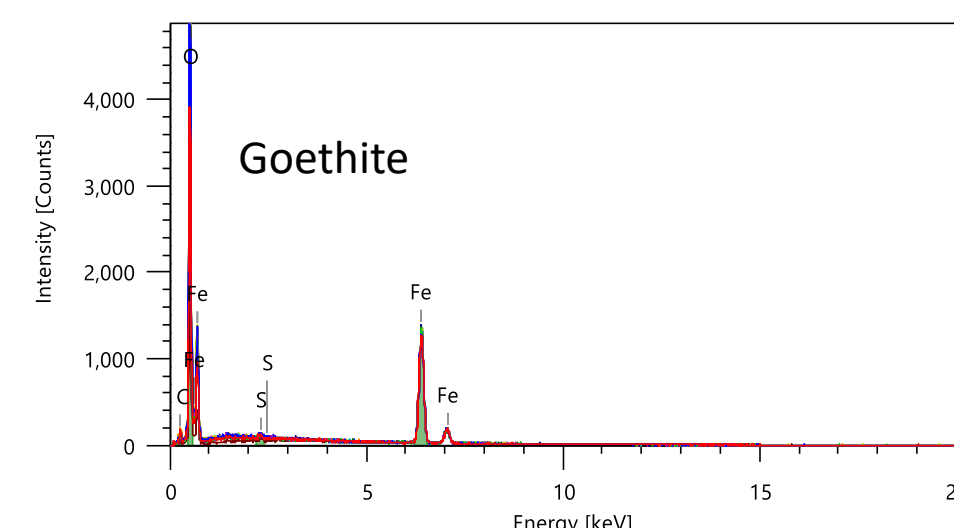
• FTIR

Adsorption of FA std on minerals does not cause any difference in their FTIR spectra. Probably, the adsorbed SOM is only in a thin layer on the mineral surfaces, also the concentrations not nearly as high than in natural soils.

• SEM

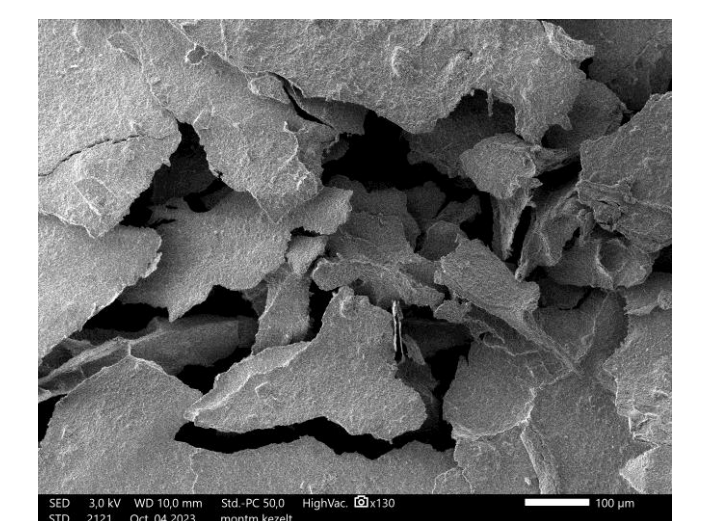
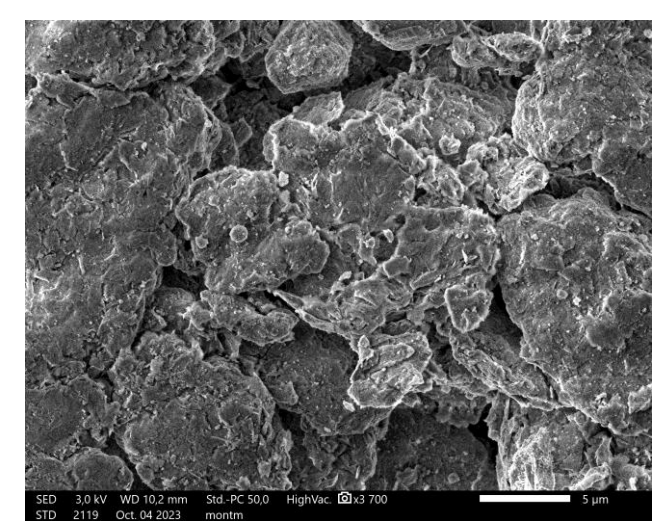
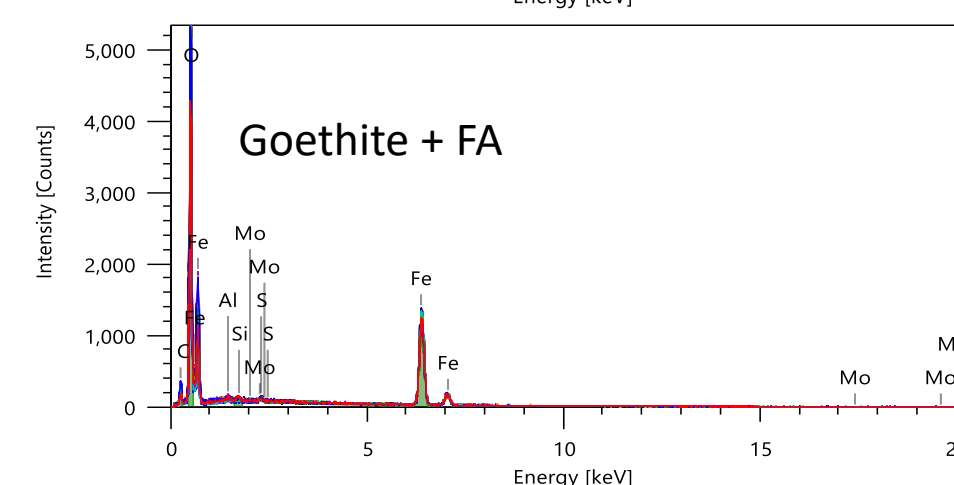
In contrast, SEM showed a more or less homogeneous SOM coating on the mineral solid particles, but only in the elemental composition.

No morphological differences



Goethite

Goethite + FA



Montmorillonite

Montmorillonite + FA

6. Conclusions

- Actual SOM attachment on the mineral surface is presumed to be the holistic result of many environmental parameters

5. Further steps

Adsorption experiments on natural parent materials treated by natural dissolved organic matter applying leaching water through the profile is planned to expand the results to quasi natural circumstances.

Acknowledgments

Supported by the ÚNKP-23-3 New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund.