TECHNISCHE UNIVERSITÄT DRESDEN

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Topic for MSc Thesis

Quantifying geogenic carbon in soil samples

Formation of soil organic matter (SOM) from plant and microbial detritus is an important driver for soil functioning, especially when vegetation cover is scarce. To study influences of plants and associated microbial life on for instance soil stability in arid environments, it is important to distinguish the formed SOM from the other soil components containing carbon as carbonates or geogenic carbon, e.g. graphite.

So far a method to quantify geogenic carbon in the form of graphite is lacking. Therefore graphite-containing soils are mostly avoided in field studies, creating a knowledge gap on both the contribution of graphite to total carbon in soils and the role of graphite in the soil environment. Thus sites containing graphite are mostly excluded to study the dynamics of SOM.

The master thesis research will focus on the comparison of several promising methods for the quantification of graphite in soil samples derived from an ongoing field study in Spain. For instance infrared spectroscopy seems to be a promising option as organic matter and soil minerals can be distinguished by their spectral signatures (Margenot et al. 2016). Another promising method is the combination of thermogravimetry and differential scanning calorimetry (TGA-DSC), which discriminates between different carbon components by their differences in thermal stability. The last method has very recently been proofed to be useful for quantifying different forms of carbon in abandoned coalmine soils (Chan et al. 2017).

Figure 1 Graphite containing parent material.

Figure 2 Study area near Almería, Southern Spain

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Interesting papers:

Baldock, J. A., Hawke, B., Sanderman, J., & Macdonald, L. M. (2014). Predicting contents of carbon and its component fractions in Australian soils from diffuse reflectance mid-infrared spectra. *Soil Research*, *51*(8), 577-595.

Chan, J., Plante, A. F., Peltre, C., Baumgartl, T., & Erskine, P. (2017). Quantitative differentiation of coal, char and soil organic matter in an Australian coal mine soil. *Thermochimica Acta*, 650, 44-55.

Janik, L. J., Skjemstad, J. O., Shepherd, K. D., & Spouncer, L. R. (2007). The prediction of soil carbon fractions using mid-infrared-partial least square analysis. *Soil Research*, 45(2), 73-81.

Margenot, A. J., Calderón, F. J., & Parikh, S. J. (2016). Limitations and Potential of Spectral Subtractions in Fourier-Transform Infrared Spectroscopy of Soil Samples. *Soil Science Society of America Journal*, 80(1), 10-26.

Plante, A. F., Fernández, J. M., & Leifeld, J. (2009). Application of thermal analysis techniques in soil science. *Geoderma*, 153(1), 1-10.

Ussiri, D. A., Jacinthe, P. A., & Lal, R. (2014). Methods for determination of coal carbon in reclaimed minesoils: A review. *Geoderma*, 214, 155-167.

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