Se-Soil Organic Matter interactions: direct or indirect association?

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Although Soil Organic Matter (SOM) has an important role on oxyanions retention in soils (eg. As, Se), the nature of interactions between those elements with SOM is not clearly known. In this study, Se (IV) was used to artificially contaminate a grassland soil ("Roth2", Rothamsted Institute, UK). Physical and chemical extractions were then used to determine the solid partition of Se. In addition, Transmission Electronic Microscopy (TEM) and Scanning Electronic Microscopy (SEM) observations (Fig.1), both coupled with EDX analyses, were realised on some isolated fractions. The Particulate Organic Matter (POM) – organic debris >50µm – which represented 29.8% of the total soil organic carbon, was particularly responsible for more than 11% of total Se retention, although it represented only 5.6% of the total soil weight [1]. Moreover, selenium sorption experiments, performed on isolated fractions (Fig.2), revealed that the POM fraction (50 to 200µm) was the most Se reactive fraction of the soil. In addition, we measured that $POM_{50\text{-}200\mu m}$ contained the highest iron concentration (4 times more Fe than $POM_{>200\mu m}$ and 2 times more than soil). As iron oxides represent an important Se carrier phase, it was expected that Se retention to POM was favoured by iron oxides surface precipitates. TEM and SEM observations showed that Se was spred onto the whole POM surface and in its core, as Fe was. Thus, Se diffused into the POM matrix and was uniformly accumulated. In addition, Se hot spots were located in the vicinity of Fe spots. Although direct Se-POM links were not excluded, microscopic observations confirmed that Se-POM associations were favored by the presence of Fe. Observations of few clay-size impurities on the POM surface did not reveal any other Se hot spots.

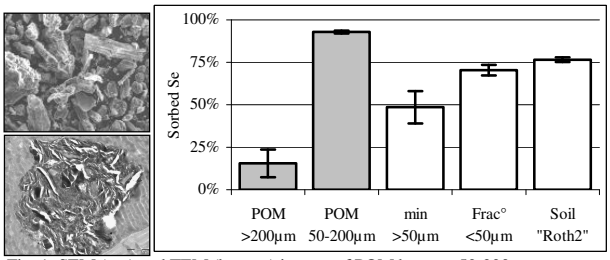

Fig. 1: SEM (top) and TEM (bottom) images of POM beween 50-200µm
Fig. 2: Selenite sorption on soil, POM (>200µm & 50-200µm), mineral >50µm and fraction <50µm; [Se]=10^{-3}M; t=48h; m/V=1/5 (except for $POM_{>200\mu m}$ 1/20)

References

[1] F. Coppin, C. Chabroullet, A. Martin-Garin, J. Balesdent and J.-P. Gaudet (2006) *BFS*, 1-8.