MAGNETIC SIGNATURES OF BIOGEOCHEMICAL PROCESSES

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Environmental magnetism applications to biogeophysics are increasingly growing over the last decade, and it is now considered a promising research field for human impacted land studies. Climate impacts on soil natural processes (e.g., droughts and floods) and soil contamination can dynamically and maybe significantly alter the subsurface natural processes. Contamination of soils and groundwater modifies the physical–chemical conditions of the environment, impacting natural biogeochemical processes in which iron often plays an important role. In biotic or abiotic processes, Fe-bearing mineral transformations are driven by the environment geochemical conditions, such as redox gradients and pH. Magnetic properties of soils and rocks are strongly dependent upon magnetic carrier grain size. Magnetic particles formed by dissimilatory iron reducing bacteria are typically in the ultrafine size range, which present superparamagnetic properties, a unique magnetic fingerprint. The presence and transformation of Fe-bearing mineral enables the study of magnetic properties of the impacted environment, which are affected by (1) magnetic mineral phases, (2) magnetic particles content and (3) magnetic particles grain size distribution. The integration of rock magnetism techniques allows magnetic properties characterization, quantitatively or quantitatively answering questions (1) – (3), which are the fundamental questions of environmental magnetism. In this presentation, I discuss magnetic signatures produced by iron cycling biogeochemical processes. Data from recently published papers will be used as examples of magnetic properties of sediment samples of a brownfield and a creosote contaminated site in Brazil. These studies suggest that some magnetic fingerprints reveal specific magnetic mineral phases, revealing mineral precipitation or redox change conditions, while others suggest microbial Fe-bearing mineral formation. In summary, magnetic properties obtained from different rock magnetism techniques can identify magnetic fingerprints and advance the understanding of how natural biogeochemical processes are impacted by human actions, such as soil contamination.