

New developments of porewater chemistry imaging at high resolution for redox-sensitive elements

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Over the past decades, numerous studies pointed out the existence of dynamic and heterogeneous micro-environments in sediments or soils at small-scale (sub-mm) ([1] and ref. therein). It has led to the development of several methods for high resolution two-dimensional (2D) imaging of solute distribution in porewaters: diffusive equilibration in thin films (DET), diffusive gradients in thin films (DGT), planar optodes. DET allows *in situ* sampling of sediment porewaters based on a diffusive equilibrium between a sampling medium (i.e. agarose or polyacrylamide hydrogels) and the natural water [2]. Combination of DET and colorimetry has already been used to characterize 2D distribution of different major chemical parameters (Fe, P, Alkalinity, pH) at a (sub)millimetre resolution ([3] and ref. therein). This presentation aims to present last developments based on DET and colorimetry achieved by our group. We recently developed new methods to obtain ammonium or manganese 2D distributions with a flatbed scanner. Achievement of some recent developments has been enabled through a major improvement, the use of hyperspectral cameras providing images with a high spectral resolution. For instance, simultaneous dissolved iron/reactive phosphorus [4] and nitrite/nitrate [5] imaging at millimetre scale were both possible thanks to signal unmixing capability given by hyperspectral imaging (HSI) analysis. These new methods enhance the valuable informations on 2D microdistribution of redox-sensitive elements in sediments or soils and will provide new insights on biogeochemical mechanisms, mobilisation/transport.

[1] Stockdale et al. (2009), *Earth-Science Reviews* 92, 81-97.

[2] Davison et al. (1991), *Nature* 352, 323-325.

[3] Santner et al. (2015), *Analytica Chimica Acta* 878, 9-42.

[4] Cesbron et al. (2014), *ES&T* 48, 2816-2826.

[5] Metzger et al. (2016), *ES&T* 50, 8188-8195.