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High resolution redox potential measurements: techniques, interpretation and value

Michel Vorenhout (1,2) and Harm G. van der Geest (2)

(1) MVH Consult, Leiden, the Netherlands (m.vorenhout@mvhconsult.nl), (2) IBED-AEE, University of Amsterdam, Amsterdam, the Netherlands (H.G.vanderGeest@uva.nl)

The ongoing improvement of techniques for the in situ measurement of redox potentials has led to a large number of studies on redox variability in various environments. These studies originate from a wide array of scientific disciplines, amongst which ecology (sediment biogeochemistry), environmental chemistry (degradation studies) and archaeology (in situ preservation). To gain insight in the potential applications, this paper presents three examples of studies in which a newly developed measurement technique was used in soils and where spatial and temporal variation plays an important role.
The first one is a microcosm study on the effects of biota on the dynamics of redox conditions in the toplayer of aquatic sediments, showing that the presence of microbiota has a direct influence on biogeochemical parameters. The second is the study of the redox potential in the world heritage site of Bryggen (Bergen, NO) that is under threat of oxidation. The oxidation, caused by a lowered groundwater table, causes soil degradation and unstable conditions for the monumental buildings of the Medieval site. The third study shows variability in a sandy flood plain in Bangladesh, where redox processes dictate the environmental behaviour of Arsenic. This toxic metal is present in many wells used for drinking water, but shows very local variation in dissolution dynamics.
In these three studies, continuous measurements of (changes in) redox conditions revealed a strong variability in these systems and consequences for the interpretation of single point measurements or low frequency sampling campaigns are discussed.
In these and many other cases, the continuous measurement of the redox potential in soil media will aid in the understanding of the system under study.