Influence of scale on trace metal dynamics in sediment and water.

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Uptake of trace metals by organisms can affect local chemical concentrations, while the concentration in turn determines the component's availability to organisms. To witness and understand these processes it is necessary to make measurements and develop models on a scale appropriate to the chemical perturbation. In water columns, where transport is rapid, relatively coarsely spaced measurements can show transient features that may only be present for days. In sediments transport is slower and much finer scales are required. The technique of DGT (*diffusive gradients in thin films*) accumulates metals in situ at a binding agent after their passage through a defined layer of hydrogel. It can make measurements of metals at a spatial resolution of 35μm in two dimensions. In sediments a microstructure of small-scale (*100μm to mm*) metal remobilisation sites can be measured. The steep, but highly localised concentration gradients of spherical geometry are introduced by local biological activity. The biology is controlling the micro- rather than the macro-scale chemistry. We have yet to appreciate fully the extent to which the micro-scale chemistry affects the biology. Combined probes that can simultaneously measure metals and sulfides, show that sulfide and metals can be remobilised at the same location, again suggesting biological origin. The focus on small-scale changes in chemical concentrations is providing new understanding of the in situ mechanisms of interaction between solutes and solid phases in sediments. Understanding the biologically-induced, 3-dimensional chemical gradients on the micron scale is providing a new paradigm for appreciating and quantitatively modelling the biogeochemistry of sediments.

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References

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