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Editorial

I am very happy to present this Research Front featuring contributions discussing and using the in-situ probe Diffusion Gradients in Thin-films (DGT) to determine trace element behaviour in environmental systems. Since its first report in 1994,[1] DGT has become an essential technique in this area; it has been validated in laboratory, field and modelling studies and applied widely to marine, estuarine and fresh waters, to sediments and to soils. DGT is based, as are many of the best ideas and techniques, on a fairly simple foundation, using supply of the trace element through a well-defined diffusive layer and capture by an infinite sink (in practice, usually, but not always, Chelex resin) to enable a calculation of trace element concentration in the original medium. As would be attested by those who have used DGT, its simple principles may be complicated in practice by the complexity of environmental media, which may demand sophisticated interpretation. The original uses were to provide a simple speciation measurement and to ensure trace element concentrations could be measured without the uncertainties involved in sampling and sample handling. However, the technique has been used to understand metal behaviour in extreme environments such as marine sediments, to probe resupply from sediment and soil solid phases and as a tool to quantify dynamic speciation and to mimic bioavailability among other uses. DGT is a now a well-established and indispensable method in these and related areas; to date (early 2012) >500 papers have been published.

This Research Front presents the state of the art in DGT science, beginning with a review by the joint originators and developers William Davison and Hao Zhang,[2] which presents a readable introduction to the origins of the method and a high level discussion of its uses and applications. The research papers that follow illustrate some of these uses and highlight the flexibility of DGT by covering applications to a range of analytes in a range of environmental media. The first two papers[3,4] discuss novel applications and developments of the technique to new measurands and potentially in trace metal speciation. The next papers[5,6] apply DGT to both trace metal and metalloid behaviour in sediments and porewaters, while the final two papers[7,8] show potential uses in understanding speciation and bioavailability. Taken together, these papers give a snapshot of the best current research on DGT and an indication of its power and utility. Despite doing so much already, it is clear that DGT will continue to develop and extend our knowledge of trace elements in the environment.

I would like to express my thanks to all the authors contributing to this special issue whose hard work and dedication (and ability to meet deadlines!) made this Research Front such high quality and also, from a personal point of view, a pleasure to edit. I would particularly like to thank William Davison and Hao Zhang for their help and advice in putting together the DGT Research Front, and for their invaluable expertise on the topic.

Jamie R. Lead, Editor

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