Towards a mineralogical view of iron colloids and nanoparticles in aquatic environments

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Iron plays an integral role in ocean biogeochemistry, regulating carbon transport and sequestration, and primary productivity [1,2] via particulate phases [e.g. 3]. These particulate phases comprise nanoparticles and colloids that range in size to below the traditional filter cut-off of 0.45 um. This means they are difficult to characterise mineralogically and often neglected as "dissolved iron". In their comprehensive 2012 review of the iron biogeochemical cycle [4], Raiswell and Canfield therefore urge to adopt a more mineralogical view to define the role of colloids and nanoparticles in aquatic environments.

Here we present an analysis of the total iron load of Scottish rivers whose iron-carrying particulates have been shown to be a source of bioavailable iron to coastal ocean waters [5]. We used a cascade of filtering techniques to collect and quantify iron particulates above and below the 0.45 um threshold. Mössbauer spectroscopy is well-suited to provide mineralogical information on nanoparticles down to ~10 nm size but the material collected from volumes of water feasible for filtering is not enough for a conventional measurement. The ultimate aim is thus to apply synchrotron-based Mössbauer applications [6], where the high luminosity and focus of the beam allows analysis of microscopic sample volumes [7].

[1] Lalonde *et al.* (2012) *Nature* **438**, 198-200. [2] Tagliabue *et al*. (2017) *Nature* **543**, 51-59. **[3]** Milne *et al.* (2017) *Geophys. Res. Lett*. **44**, doi:10.1002/2016GL072314. [4] Raiswell and Canfield (2012) *Geochemical Perspectives,* **1**(1), 1-220. [5] Krachler et al. (2016) Sci. Total Environ. **556**, 53-62. **[**6**]** Potapkin *et al.* (2012) *J. Synchrotron Rad*., **19**, 559-569. [7] Schröder *et al*. (2016) *Hyperfine Interactions*, **237**, 85.