

Particulate Organic Carbon deposition offshore Taiwan following typhoon Morakot

ROBERT SPARKES^{1,2*}, NIELS HOVIUS², ALBERT GALY², VASANT KUMAR¹ AND JAMES LIU³

¹Department of Materials Science and Metallurgy, University of Cambridge, UK (*correspondence: rbs26@cam.ac.uk)

²Department of Earth Sciences, University of Cambridge, UK

³Institute of Marine Geology and Chemistry, NSYSU, Taiwan

Woody debris and petrogenic carbon can be exported by hyperpycnal discharge from the fluvial and shallow-marine system, and stored on geological timescales in basins, but offshore storage of fresh Particulate Organic Carbon (POC) and the efficiency of burial of petrogenic carbon are poorly constrained. We present a case from Taiwan, where riverine fluxes are known [1].

Following Typhoon Morakot (2009, up to 3m rainfall), eight sediment cores totalling 191 cm were collected from turbidites in the Kaoping submarine canyon at depths up to 976 m, and from the neighbouring slope. Coarse, modern woody debris was present in 32% of core samples, exclusively within the sandy parts of turbidites. Total Organic Carbon concentrations were highest in slope deposits, averaging 0.59%, and in sandy canyon deposits. Canyon and floodplain samples had similar distributions of isotopic values, suggesting mixing of two endmembers. One is a combination of fresh woody debris and recycled coal-grade material from sedimentary rocks in the hinterland. The other is higher-grade carbonaceous material including graphite, likely from the central mountain belt. The river signal was fully preserved in the canyon. Slope deposits had a lighter ¹³C signature indicating marine organic carbon input.

Raman spectroscopy suggests that high-grade graphite and low-grade material were sourced from Plio-Pleistocene deposits in the western foreland, whilst intermediate-grade graphitic material was sourced from the central mountain belt. High-grade graphite metamorphic conditions are not exposed in Taiwan: this material must have survived at least two cycles of erosion and deposition.

[1] West *et al.* (2011) *Limnology & Oceanography* **56**(1), 77–85.

Time-resolved metal(loid) reactivity at biogeochemical interfaces

DONALD L. SPARKS^{1*}, MATTHEW GINDER-VOGEL² AND GAUTIER LANDROT³

¹Delaware Environmental Institute, University of Delaware, Newark, DE 19716, USA

(*correspondence: dlsparks@udel.edu)

²University of Delaware, and Calera Corporation, Los Gatos CA 95032 USA (mginder-vogel@calera.com)

³University of Delaware, and Lawrence Berkeley National Lab, Berkeley, CA 94720 USA (GJLandrot@lbl.gov)

The rates of important chemical processes at biogeochemical interfaces including ion exchange, sorption, and redox can occur over wide time scales. Ex-situ batch and flow techniques offer high elemental sensitivity, but their time resolution is not adequate to capture rapid reaction rates that often comprise a significant portion of many processes such as sorption and oxidation-reduction. Measurement of rapid, initial rates of environmentally important reactions at the mineral/water interface is critical in determining reaction mechanisms. Until recently, experimental techniques with sufficient time resolution and elemental sensitivity to measure initial rates were very limited. Some techniques such as pressure-jump methods can capture rapid reactions on millisecond time scales, but the rate parameters are indirectly measured and reaction mechanisms can only be inferred. Ideally, one would prefer to follow reaction rates in real-time, in situ, and at the molecular scale to definitively determine reaction mechanisms. In this presentation the use of *in situ* synchrotron-based, quick scanning X-ray absorption spectroscopy (Q-XAS), at sub-second time scales, is applied to measure the initial oxidation of As(III) and Cr(III) by hydrous manganese oxide [1], [2]. Results indicate that with these techniques, chemical kinetics are being measured. The rapid kinetic techniques are coupled with synchrotron-based XAS and XRD, and a stirred-flow technique, to provide a comprehensive assessment of As(III) and Cr(III) oxidation kinetics and mechanisms on hydrous manganese oxide over a range of temporal scales [3], [4].

[1] Ginder-Vogel, Landrot, Fischel & Sparks (2009) *PNAS* **106**(38), 16124–16128. [2] Landrot, Ginder-Vogel & Sparks (2010) *Environ. Sci. Technol.* **44**(1), 143–149. [3] Lafferty, Ginder-Vogel & Sparks (2010a) *Environ. Sci. Technol.* **44**, 8460–8466. [4] Lafferty, Ginder-Vogel, Zhu, Livi & Sparks (2010b) *Environ. Sci. Technol.* **44**, 8467–8472.