

## Expanding potential source area studies of dust in East Antarctica by integrating trace element chemistry and radiogenic isotopes

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By studying dust records preserved in Antarctic ice cores, we can evaluate variability in dust source areas over geologic timescales. For instance, it has been determined that during the Last Glacial Maximum (LGM), South America was the dominant dust source for the entire East Antarctic Plateau [1,2], whereas ice core analyses from the Talos Dome reveal that the fraction of large particles deposited during the Holocene was significantly greater than during the LGM, indicating contribution from proximal, Antarctic sources. These findings differ from cores drilled further inland on the East Antarctic Ice Sheet (EAIS), such as the Dome C core [1,3,4].

Here we provide new results of trace Rare Earth Element (REE) chemistry and Sr-Nd, Hf signatures of  $<5\mu\text{m}$  diameter and bulk samples from 19 potential source areas (PSAs) in northern and southern Victoria Land (NVL and SVL), including from the ice-free McMurdo Dry Valleys (MDV). Because records from the Talos Dome currently suggest that ice-free areas such as the MDV may be important sources for local, wind-driven dust transport on the EAIS after the LGM, we expect to observe similar trends when comparing our PSA samples from SVL to Holocene dust profiles from the Taylor Dome core, and likewise from NVL to Holocene profiles in the Talos core.  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $\epsilon_{\text{Nd}}$  compositions from our PSAs are similar to existing PSA records from Antarctica.

At present, Sr and Nd isotopic systems are commonly used to identify dust provenance in Antarctic ice cores [1], however, such studies have yet to be complimented with Hf signatures and REE chemistry. Thus, forthcoming results from this study may be especially useful for distinguishing dust flux evolution during the last deglaciation.

[1] Delmonte *et al.* (2010) *Journal of Quaternary Science* **25**, 1327-1337. [2] Gaeiro *et al.* (2007) *Chemical Geology* **238**, 107-120. [3] Delmonte *et al.* (2002) *Annals of Glaciology* **35**, 306-312. [4] Kohfeld and Tegen (2007) *Treatise on Geochemistry*, 1-26.

## Modelling the migration of mercury in a column experiment: biotic against abiotic mechanisms

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Apart from the behavior of mercury in terrestrial surface aquatic environment, few data are still available concerning its migration in subsurface and deep aquifers. A column experiment had been design in order to reproduce the Hg methylation by sulphate and iron reducing bacteria. Based on the experimental results, a modelling exercise had been carried out to enlighten the chain of reactions responsible for methylmercury formation in such an environment.

The numerical modelling is realised by using the PhreeqC-2 code [1] and the Thermodem database [2]. The hydrodynamics of the column is first parameterized by modeling a tracer test, allowing to realistically adjust a double porosity model. Then, the inorganic part of the model inputs include the solid substrates used (silicic sand + iron hydroxydes previously spiked with a mercury nitrate solution) and the inflowing solution. In the latter cases, this includes the chemical perturbations induced by three successive bacterial inoculation events. The organic part of the model strats from the inoculum preparation and takes into account the nature of the bacterial load (sulphate and iron reducing) and the addition of an organic substrate (Na-Lactate).

For the parameters pH, Eh,  $[\text{S}]_{\text{T}}$ ,  $[\text{Fe}]_{\text{T}}$  and  $[\text{Hg}]_{\text{T}}$ , a satisfactory agreement is found by considering only the inorganic part of the chemical system. The total dissolved mercury concentration is slightly improved by adding a non electrostatic Hg surface complexation model. Methyl mercury is also produced. However, its amount in the analysed samples is shown to depend strongly on the presence of potential methyl donors in the inflowing solution.

[1] Parkhurst and Appelo (1999) USGS WRIR 99-4259, [2] Blanc *et al.* (2012) *Appl. Geochem.* **27**, 2107-2116.