

The organic nitrogen fraction of deposition over the North Atlantic

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The input of atmospheric nitrogen to the oceans is increasing because of anthropogenic alteration of the nitrogen cycle. Because of its proximity to land, the oligotrophic North Atlantic subtropical gyre in particular may receive enough new N from deposition to enhance new production and possibly to push the system towards P limitation [1,2]. However, estimates of nitrogen deposition to the ocean are still highly uncertain because of the dearth of deposition measurements in marine environments and the limitations in the range of N species measured. Of particular interest are water soluble organic nitrogen (WSON) compounds that, based on early estimates, could contribute around 30% of the ocean nitrogen deposition flux [1,3] and may be bioavailable. However WSON data are few in number and they are temporally and spatially limited.

Here we present the results of measurements of atmospheric WSON in wet deposition and aerosols which were sampled continuously in Miami and periodically in Barbados during 2007 - 2008. Deposition of WSON was approximately 3.3 and 2.0 mmol N m⁻² yr⁻¹ in Miami and Barbados, respectively, and attributed only ~10% of the total soluble N deposition. Because of the dominance of marine air masses at our sites, the low fraction of WSON to total soluble N we observed may be more representative of deposition over the oceans than measurements taken at sites more influenced by terrestrial sources. Our results support the conclusion that the assumption of 30% WSON in N deposition is not appropriate for the North Atlantic.

[1] Duce *et al.* (2008) *Science* **320**, 893-897.
[2] Krishnamurthy *et al.* (2007) *JGR* **112**, G02019, doi:10.1029/2006JG000334. [3] Jickells (2006) *Biogeosci.* **3** 271-280.

Chemical and isotopic relationship between matrix and chondrules in ordinary and carbonaceous chondrites

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The oxygen isotopic composition of chondrites may be interpreted in terms of mixing of chondrules, refractory inclusions (RI) and matrix [1]. At the time of accretion, ¹⁶O abundance variations (expressed in terms of $\Delta^{17}\text{O}$) must have been carried by chondrules and RIs, whereas mass fractionation (expressed in terms of $\Delta^{18}\text{O}$) was carried by the matrix. RIs and chondrules are high temperature components and hence depleted in volatiles, whereas matrix is expected to be the seat of these species as well as of presolar grains.

Beyond these broad lines, the specifics remain poorly understood: it is unclear (a) how chondrule compositions vary between chondrites or chondrite groups and what fraction of the volatile elements they do carry (b) whether matrix presolar grain and volatile element abundances vary - with the possibility of a matrix-chondrule complementarity as advocated by [2] - or (c) whether the volatile element budget of chondrites is exclusively determined by their relative proportions of matrix and high T components.

We studied the volatile element and presolar grain content of bulk chondrites as a function of their matrix modal abundance and $\Delta^{18}\text{O}$. We show that the budget of presolar diamonds and of the most volatiles species (H₂O, C, N) in the least metamorphosed chondrites is entirely determined by their matrix abundance. The case for less volatile elements is more complex. Some of them (e. g. Au) appear to be present in chondrules as well as in the matrix. S is present in the chondrules of OCs but not of CCs indicating that, even if abundance of high T components vs matrix is responsible for the first order variations of volatile element abundances, changes in chondrule compositions determine a second order of volatile element variations. A complementarity of compositions between chondrules and matrix cannot be ruled out.

[1] Zanda *et al.* (2006) *EPSL* **248**, 650-660. [2] Bland *et al.* (2005) *PNAS* **102**, 13755-13760.