Particulate trace metals and dust particles in the subtropical Atlantic

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During the expedition Meteor M81/1 in the subtropical Atlantic Ocean (GEOTRACES Cruise A11; February/March 2010) particulate trace metals were sampled (by using *in situ*-pumps) to study (i) the fate of dust particles in the water column, (ii) its impact on the vertical distribution of particulate trace metals and (iii) to investigate the interaction between trace elements in solution and in the particulate phase.

The cruise track from the Canary Islands to the Brasil basin followed an approximate gradient from high to low dust input. While mineral dust and aerosol deposition is the most important source of trace elements in the open subtropical Atlantic, the surface distribution of particulate trace metals is also affected by the biotic productivity and the rate of organic matter sedimentation which tends to remove the mineral particles from the surface ocean and also decreases along the cruise track.

There is evidence to suggest that the small dust particles do not sink by themselves but that they are removed from the mixed layer by forming aggregates with sticky organic particles. These aggregates might be large enough to leave the surface ocean rapidly, sink, disaggregate, re-aggregate, etc., thus producing an observable vertical distribution of e.g. particulate Al (taken as a proxy for dust particles).

For this assemblage of processes acting on the distribution of suspended dust particles (including aggregation between organic and mineral particles, disaggregation and joint sinking) a model has been developed. The simulated concentration profiles of refractory trace metals (of suspended dust particles) are strongly related to the rate of atmospheric dust deposition and show a similar pattern as in the observed vertical concentration profiles.

Below the surface mixed layer, the different particulate trace metals exhibit extreme differences in the vertical distribution depending on the major form of their particulate transport: the concentration of the more refractory metals in inorganic entities (e.g. Al, Fe, Mn) tend to be constant or even increase with depth, while the nutrient-type elements (e.g. Cd, Ni) being associated with organic particles exhibit dramatic decreases of the concentration with depth in the deep sea. The results for the different elements are compared with those from a similar cruise in 1997 to evaluate interannual variability.

Petrogenesis of monotonous dacitic Taapaca Volcanic Complex, N. Chile

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Taapaca Volcanic Complex (TVC) located in the Andean Central Volcanic Zone (18°S) generated monotonous high porphyric dacites (61-65.5 wt.% SiO_2) during its main eruptive history ~1 Ma [1]. Taapaca dacites show textural and mineralogical characteristics similar to the Fish Canyon Tuff [2], including sanidine megacrysts, lack of pyroxene and presence of mafic inclusions.

The occurrence of sanidine megacrysts up to 12 cm in length in intermediate volcanic rocks is a unique feature. All Taapaca sanidine show similar growth patterns, pronounced Ba-zoning, and invariable incompatible trace element contents as well as Sr- and O- isotopic compositions. Chemical characteristics of the sanidine, enclosed plagioclase, and magnesiohornblende compositions suggest crystallization in a closed-system at 700-770°C and 1.0-3.4 kbar. Microphyric basalt andesitic inclusions (52-54 wt.% SiO_2) in Taapaca dacite show a uniform mineral assemblage of plagioclase, magnesiohastingsite and Fe-Ti oxide with varying proportions of incorporated felsic components. The mafic inclusions represent compositionally two kinds of parental magma reported from neigbouring Parinacota Volcano [3], differing significantly in Sr and Ba contents, FeO^*/TiO_2 and REE patterns. Estimated P-T conditions from magnesiohastingsite composition reveal 900-1020°C and 2-8 kbar. Taapaca dacites reveal both P-T ranges obtained from two coexisting amphibole and plagioclase populations.

The composition of the dacites and compositionally diverse hybrid mafic inclusions form an array of distinct mixing lines, which converge to one rhyodacitic composition. The composition of the dacites indicates mixing between an evolved sanidine-bearing end-member composition of ~68 wt.% SiO_2 and a range of basaltic andesites in the constant ratio of 3:1. Neither basaltic andesite nor rhyodacite erupt as end-member compositions at Taapaca Volcano. Following reactivation, the uniform dacitic composition of TVC sugessts steady-state magma throughput, and a uniform volume-ratio between remobilized resident rhyodacite crystal mush and variable mafic input.

[1] Clavero *et al.* (2004) *J. Geol. Soc., London* **161**, 603-618.
[2] Bachmann *et al.* (2002) *J. of Pet.* **43**, no. 8, 1469-1503.
[3] Hora *et al.* (2009) *EPSL* **285**, 75-86.