

## Stable isotopes of snow precipitation at Concordia station (East Antarctica)

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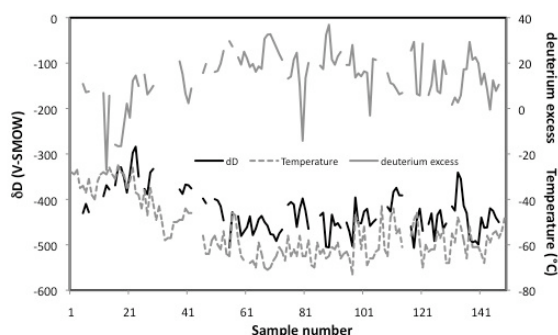
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The main key factors controlling the oxygen and hydrogen isotope composition of present-day Antarctic precipitation are mainly related to the condensation temperature of the precipitation and the origin of the moisture [1]. In order to calibrate the isotopic tool a multiyear survey from 2006 to 2010 has been carried out in the inland plateau site of Dome C (75°06'S 123°21'E; 3233 m; T=-54.5°C; snow acc. rate 25 kg m<sup>-2</sup> yr<sup>-1</sup>) in East Antarctica.

Here we present  $\delta^{18}\text{O}$ ,  $\delta\text{D}$  and deuterium excess (d) data obtained from daily snow depositions. Observations of deposition amount, shape and size of crystals were also determined. The isotopic data will be also studied as function of synoptic meteorological conditions, using ECMWF re-analyses data and back trajectory models. Preliminary data suggest a good correlation between  $\delta\text{D}/\delta^{18}\text{O}$  and temperature, both in anti-phase with d at seasonal scale (Fig. 1).



**Figure 1:**  $\delta\text{D}$ , temperature and d data of DC precipitation.

[1] Masson-Delmotte *et al.* (2008) *J. Clim.* **21**, 3359-3387.

## Computational approaches to hydrothermal fluid-rock interaction on nanometer to kilometer scales

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Fluid-rock interaction in hydrothermal systems plays a central role in processes such as the formation of ore deposits, geothermal energy production, and global element cycles. A quantitative understanding of fluid-rock interaction requires looking at vastly different length (nm to km) and time (ps to Ma) scales. Chemical thermodynamics provides the framework that links the scales and computational approaches are essential for both improving thermodynamic models and applying them in the modeling of natural processes.

In spite of decades of research, a universal model of the thermodynamics of fluids at high temperature, pressure and salinity is still lacking, which hampers our ability to quantitatively model fluid-rock interaction in systems such as mid-ocean ridge hydrothermal convection or magmatic-hydrothermal ore formation. Existing equations of state are based on physical concepts that do not reflect the molecular interactions in fluids under those conditions. Hence, molecular simulation has become increasingly popular to better understand the nm-scale physics of hydrothermal fluids. In particular, short-range solute-solvent and solute-solute interactions such as solvation and ion pairing are studied since they are not captured by the most common semi-empirical activity models. While many new insights have been gained from molecular simulation, incorporating them into equations of state is still in its infancy.

On the application side, reactive transport computations combine chemical speciation and fluid transport codes to study the progression of fluid-rock reaction fronts in permeable media on macroscopic scales. These tools have so far only rarely been applied in a hydrothermal context, partly for the reasons outlined above, and partly because most of the available codes are restricted to groundwater flow equations that do not adequately describe the flow of compressible and/or boiling hydrothermal fluids. With the recent revival of research on geothermal systems, new codes are emerging that utilize advanced hydrothermal fluid flow codes that can also simulate flow in complex, "realistic" geometries of fractured geological media. First results indicate that correctly representing geometries is key to understand the causes of heterogeneity in evolving fluid-rock interaction.