

## Experimental determination of CO<sub>2</sub>/H<sub>2</sub>O in subduction zone fluids by GC-TCD analysis

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Carbon recycling in subduction zones plays an important role in the evolution of climate through geological time and in the formation of diamonds in the deep mantle. Carbonates formed during seafloor alteration of the oceanic crust are buried into the deep Earth along subduction zones. Experimental studies on the phase stability in H<sub>2</sub>O-CO<sub>2</sub>-bearing basaltic compositions indicate that the fluid at sub-arc depth is dominated by H<sub>2</sub>O [1]. However, experimental studies are hampered by the difficulty to estimate accurately the H<sub>2</sub>O/CO<sub>2</sub> of the fluid in the experimental products.

We conducted experiments with a starting material made of a synthetic K<sub>2</sub>O, CO<sub>2</sub> and H<sub>2</sub>O-bearing basaltic composition between 3.0 and 3.5 GPa, 700 - 775°C in a piston-cylinder apparatus. The experimental results indicate that the solidus occurs between 700 and 750°C at both 3.0 and 3.5 GPa. At T ≤ 750°C, dolomite and magnesite coexist with garnet, omphacite, phengite, epidote, coesite, rutile ± kyanite. At T ≥ 750°C, Mg-calcite ± dolomite coexist with melt, garnet, omphacite, epidote, rutile ± coesite and phengite.

The experimental capsules have been pierced under vacuum and the experimental gas, mixed with pure He, has then been directly analysed with an Agilent Technologies 6850 gas chromatograph equipped with a thermal conductivity detector (GC-TCD). The accurate determination (±5%) of small quantities of CO<sub>2</sub> and H<sub>2</sub>O in a He mixture by GC-TCD method has been validated in using pure standards of these gas and the elaboration of the calibration lines between their partial pressures in a He mixture versus the peak area read in the chromatograms. P<sub>CO<sub>2</sub></sub>/P<sub>H<sub>2</sub>O</sub> of the gas mixture in equilibrium with the sub-solidus assemblages decreases with pressure from 6.3 to 4.0, confirming the previous estimations of low CO<sub>2</sub> contents in such aqueous fluids [1]. The gas mixture released from experiments above the solidus is characterised by P<sub>CO<sub>2</sub></sub>/P<sub>H<sub>2</sub>O</sub> ranging from 6.1 to 3.6. This indicates that some H<sub>2</sub>O and CO<sub>2</sub> are released from the glass during quenching. Therefore, analyses of the glass and the quench fluid are needed in order to quantify the CO<sub>2</sub> release during partial melting of altered oceanic crust.

[1] Poli *et al.* (2009) *EPSL* **278**, 350–360.

## Influence of different sources on cloud condensation nuclei numbers in the high Arctic

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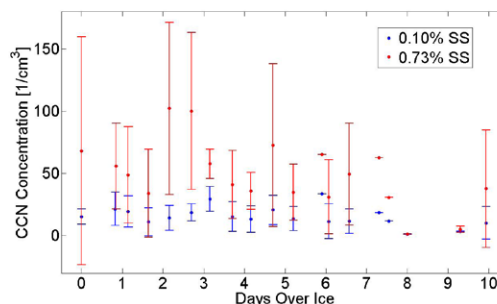
### Introduction

A thin cloud layer is often observed in the high Arctic in summer. The sources of particles in this region that act as cloud condensation nuclei (CCN) can be long-range transport from continental sources, but also primary particles emitted from the Central Arctic Ocean including the pack ice area, and secondary formed from local sources or transported precursors might contribute.

The ASCOS (Arctic Summer Cloud Ocean Study) campaign on board an icebreaker was undertaken into the high Arctic in summer 2008 to investigate aerosol properties. Measurements from two CCN counters are presented.

### Results and Discussion

CCN properties were analysed and classified based on different meteorological conditions, and CCN number concentrations were correlated with different air mass source regions. The CCN concentration and the activated fraction was very variable throughout the campaign.



**Figure 1.** Measured CCN concentration at 0.10 and 0.73% supersaturation as a function of the number of days the air spent over the ice.

The data was also investigated using the time, which the air masses spent over the pack ice before reaching the ship (see Fig. 1). High concentrations after a few days over the ice can be taken as a hint for local particle sources.