

Discrimination of secondary organic aerosol from different sources

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Secondary organic aerosol (SOA) comprises a major fraction of the submicron aerosol mass [1]. It consists of thousands of different compounds, and undergoes permanent chemical evolution during the atmospheric aging process, resulting in an increasingly oxidized aerosol [2]. As a result of this, chemical features of SOA (such as unit mass spectra from aerosol mass spectrometry) become increasingly similar with increasing aging time. This is good news for modeling purposes, as the specific SOA source becomes less important for the quantification of the SOA impact e.g. on climate. However, this also means that it is difficult to perform an apportionment of the SOA to its various sources, e.g., by positive matrix factorization [3]. We have investigated SOA formation from a variety of sources, including both combustion exhaust (with either the full exhaust or only the gaseous precursors) [4, 5], as well as anthropogenic and biogenic model precursors such as trimethylbenzene and α -pinene. We characterized the formed SOA using a high resolution time-of-flight aerosol mass spectrometer. The various fragments obtained from the high-resolution spectra were tested for characteristic differences using a variety of methods. The results will be discussed along with a comparison to high-resolution aerosol mass spectra from ambient samples.

[1] Hallquist *et al.* (2009) *Atmos. Chem. Phys.* **9**, 5155-5236.
[2] Jimenez *et al.* (2009) *Science* **326**, 1525-1529. [3] Lanz *et al.* (2007) *Atmos. Chem. Phys.* **7**, 1503-1522. [4] Chirico *et al.* (2010) *Atmos. Chem. Phys.* **10**, 11545-11563. [5] Heringa *et al.* (2011) *Atmos. Chem. Phys. Discuss.* **10**, 8081-8113.

How does the slab component get across the mantle wedge?

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Arc lavas are enriched in volatiles, LILE and LREE with respect to MORB. This enrichment is attributed to mantle metasomatism by a slab-derived fluid phase (slab component). There has been great progress in the last years to constrain the nature and composition of this fluid phase. The slab fluid is in disequilibrium with the mantle wedge and the way how it reacts with peridotites is crucial for understanding subduction recycling of volatiles and trace elements. In this contribution, evidence from natural rocks and experiments are presented to constrain the nature and extent of mantle wedge metasomatism by slab-derived fluids.

Contacts between felsic and ultramafic rocks in high- and ultrahigh-pressure terrains can be used as proxies for processes acting at fore-arc (50-80 km) and sub-arc depth (80-120 km), respectively. Interaction of aqueous fluids released from felsic rocks at fore-arc conditions ($P=10-20$ kbar, $T \sim 600^\circ\text{C}$) with peridotites leads to metasomatic rinds that are rich in talc, amphibole and phlogopite. Phlogopite sequesters most of the LILE and thus residual fluids are very dilute. At higher pressures and temperatures, interaction of hydrous melts with peridotites produces garnet and orthopyroxene and minor phlogopite and residual fluids show some enrichment of LILE and LREE.

Experiments were designed to constrain interaction of a slab-derived hydrous melt with harzburgites during porous and channel flow. The porous flow experiments produced a highly metasomatized peridotite consisting of amphibole, phlogopite, olivine, orthopyroxene and an aqueous fluid at subsolidus condition. Amphibole and phlogopite host significant amounts of LREE and LILE, respectively. The wet solidus in this metasomatized mantle wedge peridotite is at 900°C at 25 kbar and at 950°C at 35 kbar. The extent of mantle metasomatism in layered experiments, mimicking channel flow, is minimal. At the interface between the slab melt and olivine a small $\sim 200\mu\text{m}$ wide layer of garnet-orthopyroxenite forms that shields the melt from further interaction with the olivine grains. Most importantly, no phlogopite and amphibole have been observed in all such experiments. Therefore, data from natural rocks and experiments indicate that channel flow appears to be the most efficient way to transfer trace elements from the top of the slab to the locus of partial melting in the mantle wedge.