

## New experimental constraints on slab top conditions

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Subduction zones give rise to arc volcanism because fluids and/or hydrous melts that are released from the slowly heating subducted slab trigger melting in the overlying mantle wedge. The arc geochemical signature points towards a ternary mixture of a melt from subducted sediment, fluid from basaltic oceanic crust and depleted mantle peridotite. The use of the arc geochemical signature in combination with experimental petrology on phase relations, melting and trace element behaviour is therefore key for constraining the P,T,fO<sub>2</sub> conditions in subducted slabs. The aim of this presentation is to place such constraints, using our latest experimental results on subducted sediment and basalt.

A nice example is given by the geochemical signal of the Mariana Arc. Here, the pelagic sediments dominate the incompatible trace element budget over volcanoclastics in the sedimentary column, whereas the volcanoclastics are predominant in the arc geochemical signature. Our study on the melting phase relations of natural volcanoclastic sediments at 3-6 GPa and 800-900°C [1] has revealed that biotite control melting at these conditions in this lithology. The vapour-saturated solidus for volcanoclastic sediments is higher (825-850°C) than in other, phengite bearing marine sediments (700-750°C) at 3 GPa. This trend is reversed at high-pressure conditions (6 GPa) where the biotite melting reaction occurs at lower temperatures (800-850°C) when compared to the phengite melting reaction (900-1000°C). This places tight constraints on slab top temperatures beneath the Mariana Arc at 180 km depth (6 GPa). It must be above the biotite melting reaction (>800°C) but below the phengite melting reaction (<900°C), preventing pelagic sediments from releasing all their incompatible elements into the liquid phase. Another set of experiments using natural altered oceanic crust provide further constraints. Here, we find that the elevated Ba/Th ratio characteristic of many (sediment-starved) arc basalts is only generated within a narrow temperature field (800-850°C), above phengite breakdown but below epidote-out.

[1] Martindale *et al.* (2013), *Chem Geol* **342** 94-109.

## Micromorphology of diamond resorption at 100 kPa: The role of metal ions

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Natural diamonds show various resorption features produced during ascent in kimberlite magma. Experiments conducted at 100 kPa and 900 °C in KOH melts with constant flow of H<sub>2</sub>O vapor or CO<sub>2</sub> gas in the presence of ions of elements common in natural kimberlites (Mg, Ca, Sr, Al, Si, Fe, Cr, Ni, Co, REE) and in mantle minerals (olivine, ilmenite) demonstrated strong catalytic effect of some metal ions on diamond dissolution rate. We report a detailed investigation of micromorphological features induced on diamond surface in these experiments. We examine individually the effects of the oxidizing media, of the catalytic ion, and of the pre-existing defects in diamonds.

The study uses crystals of natural diamonds after loss of 50-80% of the initial weight. Field-Emission SEM and Atomic Force Microscope were used for surface characterisation. It is shown that for the same catalyser ions etching in aqueous fluids leads to smoother surfaces, whereas CO<sub>2</sub>-fluids leaves extremely rough surfaces. In presence of the strongest catalysers (Fe, Cr, Ni ions) the {110} faces show rounded steps. Other strong catalysers (Sr,Cr + Si, ilmenite) produce deep positive trigons of various shapes and sizes on {111} faces. The weakest catalysers (Ca, Mg, Si ions, olivine, natural kimberlite) reveal fine details of {110} faces and shallow trigons on {111} even at low H<sub>2</sub>O and CO<sub>2</sub> concentrations. In fragmented diamonds severe resorption exhibited internal growth structure and defects. Besides influence of extensive parameters, heterogeneities of internal structure (e.g. growth/resorption features); traces of deformation-related features and other defects play important role in formation of final surface morphology.