Monomeric and polymeric silica sorption on calcite

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Literature data about sorption of dissolved silica by calcite is fairly sparse and contradictive. Klein and Walter [1] investigated silica uptake at pH 6-8.3 and reported adsorption to be strongly pH dependant, with a maximum at pH 6. On the other hand, in flotation studies where sodium silicate was used as a depressant to suppress the flotation tendency of calcite, the experiments were mostly performed at pH > 8 and silica adsorption by calcite was reported to reach maximum at pH 9 to 10 [2, 3, 4]. In addition, the role of silica polymer adsorption in suppressing calcite flotation is unclear. Some authors [2] did not find any relationship with polymeric silica while others [3, 4] reported polymer adsorption to be responsible for suppression. Our study aimed to clarify the pH dependence of silica uptake by calcite and the importance of silica polymers in the process.

We investigated sorption of dissolved silica on calcite at 25 ºC in calcite equilibrated solutions with pH ranging from 6 to 11, with varying initial silica concentration (≤ 2 mM) and surface area to liquid ratio (≤ 480 m^2/L). The experimental conditions were designed such that polymeric silica introduced with the concentrated stock solution is stable at pH > 9 but unstable at lower pH.

Silica uptake was observed to increase with pH. At pH 11, almost 50% of the dissolved silica was removed from the solution, while no silica sorption was found at pH 6.1. The presence of stable silica polymers at pH > 9, is at least partly responsible for this pH dependence. At pH 8.3, we observed a significant, but temporary uptake of silica. It was released again to solution after several hours. This is consistent with silica being dominantly adsorbed as polymeric species and desorbed in response to depolymerisation.

[1] Klein and Walter (1995) *Chem. Geology* **125**, 29-43 [2] Marinaki and Shergold (1985) *Int. J. Miner. Process.* **14**, 177-193. [3] Hanumantha Rao *et al.* (1989a) *Colloids Surf.* **34**, 227-239. [4] Hanumantha Rao *et al.* (1989b) *Int. J. Miner. Process* **26**, 123-140.

Melt evolution from the mantle wedge to the crust: insights from South Kamchatka and West Bismarck arc xenoliths

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Rare xenoliths carried by recent andesites or arc tholeiites are the only direct witnesses of active sub-arc processes. We present a detailed study on such xenoliths from Avacha volcano in southern Kamchatka (Russia) and Ritter volcano, West Bismarck Arc (Papua New-Guinea Region). Avacha is located on a 'mature' subduction zone (~120 km Pacific slab depth, ~40 km crustal thickness). Harzburgites cut by websteritic veins, as well as massive olivine- and hornblende-clinopyroxenites and hornblendites occur in Avacha andesitic deposits (≤7000 yrs. BP). Based on the compositions of minerals, melt inclusions and interstitial glass, we infer that the websteric veins formed from high-Ca boninites (HCB). Unlike a previous study [1], this inference is consistent with recent reports of complementary low-Ca boninites (LCB) in these rocks [2]. Similar datasets show that clinopyroxenites and hornblendites crystallized respectively at Moho and mid-crustal depth, producing residual liquids similar to Avacha andesites. Modelling suggests that these 'cumulate' rocks can form from an ascending HCB melt, modified by fractionation and melt-rock reactions in the lithospheric sub-arc mantle.

Ritter is part of an active and complex subduction zone (~120 km depth for the Solomon Sea Plate slab and ~20 km crustal thickness). Harzburgites, pyroxenites and dunites are found in picritic arc tholeiites (≤125 yrs. BP) from Ritter. We show with the same toolbox, that pyroxenites and dunites are former primitive sub-arc melt channels. Evidence for LCB percolation in veins through these samples supports the current generation of boninitic mantle melts, like for Avacha.

In line with literature datasets on exhumed arc sections, we propose that boninites are common primary mantle wedge liquids in various types of subduction zones. Supported by our dataset on harzburgites, this puts direct constraints on mantle wedge melting beneath arcs. The possible HCB-andesite liquid line of evolution leads us to re-examine melt ascent and element flux models for subduction zones.

[1] Ishimaru & Arai (2011), *CMP*. [2] Bénard & Ionov (2012), *G3*.

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