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High temperature SO_2 adsorption by volcanic glasses: New implications for gas scavenging processes in the eruption plume

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The impacts of volcanic ash in the environment may be modified by gas scavenging processes by ash surfaces within the volcanic eruption plume. Current understanding of the potential environmental impacts associated with in-plume modifications to ash surface chemical properties, i.e. through the emplacement of soluble surface salts, is impeded by a limited understanding of the mechanisms controlling gas scavenging within the plume. During SO_2 adsorption experiments on volcanic glasses at 25-800˚C, crystalline $CaSO_4$ was found to be the sole reaction product at $>$500˚C. $CaSO_4$ was hypothesised to be formed by segregation from the glass surface driven by Ca diffusion from the glass interior. This study has illustrated that gas scavenging reactions are not simply a product of gas adsorption and acid condensation on solid ash particle surfaces, but may be controlled by more complex processes acting on molten ash surfaces in the high temperature eruption plume. It may be possible that these high temperature processes may extend into the subsurface volcanic or magmatic environments. Surface modification at high temperature may dictate the extent of gas scavenging and the formation of any associated reaction products upon ash surfaces, and so may influence the extent of any potential environmental impacts occurring after ash emission.