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Chemical heterogeneity in volcanic glass from Chaiten volcano

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Diffusion in hydrous silicic melts is generally faster than diffusion in minerals. As a result, volcanic glass is commonly thought to be largely homogeneous in composition on a micro and even outcrop scale, and often overlooked as an archive of magma evolution. However, more and more evidence is emerging that there is chemical heterogeneity in volcanic glass, and even diffusion profiles, over a range of length-scales. This heterogeneity has been shown both in slower diffusing elements and species, as well as in the fastest diffusing species, including in H2O. The magmatic processes that cause this heterogeneity are varied and range from crystallisation, to resorption, to magma mingling and assimilation, to degassing. This contribution explores the extent and complexity of chemical heterogeneity in volcanic glass for a comprehensive suite of elements using a wide range of micro-analytical techniques. The aims are to identify the processes responsible for creating the observed heterogeneity and to use this chemical heterogeneity to constrain the time scales for these magmatic processes. The 2008 eruption of Chaiten volcano, located in southern Chile, erupted sparsely-phyric rhyolitic bombs. Volcanic bombs sample the upper part of the magmatic conduit and their rapid cooling has the potential to preserve melt chemical heterogeneity as it quenches to glass. Samples from a diverse range of volcanic bombs were analysed using in-situ SR-XRF, FTIR, EMP and LA-ICP-MS. These volcanic bombs show chemical heterogeneity on a micro- and millimeter scale in a diverse suite of major and trace-elements, including K, H, Pb, As, Tl, and Li. Here, we show why this chemical heterogeneity can be attributed to magma degassing and what can be learned from this.