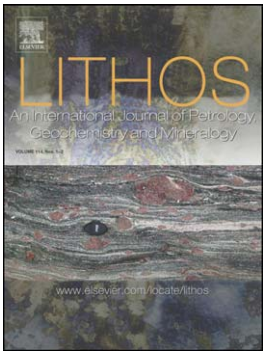

Silicic magma differentiation in ascent conduits. Experimental constraints

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Silicic magma differentiation in ascent conduits. Experimental constraints

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KEYWORDS: ascent conduits, crystallization experiments, differentiation, silicic magmatism, andesite, autoliths.

ABSTRACT

Crystallization of water-bearing silicic magmas in a dynamic thermal boundary layer is reproduced experimentally by using the intrinsic thermal gradient of piston-cylinder assemblies. The standard AGV2 andesite under water-undersaturated conditions is set to crystallize in a dynamic thermal gradient of about 35 °C/mm in 10 mm length capsules. In the hotter area of the capsule, the temperature is initially set at 1200 °C and decreases by programmed cooling at two distinct rates of 0.6 and 9.6 °C/hour. Experiments are conducted in horizontally arranged assemblies in a piston cylinder apparatus to avoid any effect of gravity settling and compaction of crystals in long duration runs. The results are conclusive about the effect of water-rich fluids that are expelled out the crystal-rich zone (mush), where water saturation is reached by second boiling in the interstitial liquid. Expelled fluids migrate to the magma ahead of the solidification front contributing to a progressive enrichment in the fluxed components SiO_2, K_2O and H_2O. The composition of water-rich fluids is modelled by mass balance using the chemical