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DDC-driven fractionation from mixing and layered convection experiments in phono-trachytic magmas: REE- and trace elements distribution

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Geochemical and volcanological data on the Campanian Ignimbrite, ($>$200 km^3, 39 ka) Phlegrean Fields, Italy, support the existence of a layered magmatic reservoir, which evolved via 1) replenishment of the chamber with trachytic magma and 2) short-term pre-eruptive mixing between new trachytic and phono-trachytic resident magmas.

This work presents new analytical results from an experimental program in order to constrain the dynamics of such mingling/mixing events. We used melted natural products from these two magmas of sub-equal but distinct composition, which are thought to have been involved in the origin of this magmatic system as end-members (phono-trachyte = end-member A and trachyte = end-member B). The two were then stirred together and sampled by experiment termination as a time series, ranging from 1-hour up to 1-week. Stirring under constant low flow velocity (0.5 rotations per minute) generated at first homogenization and mixing of the starting compositions. Then separate convection cells and compositional layering for major, minor and trace elements emerged. After 16-hours the ^{87}Sr/^{86}Sr-isotopic system is homogenized. After 25-hours inhomogeneities in the ^{87}Sr/^{86}Sr-isotopic system may be explained by the vertical and lateral zoning and local incomplete mixing in the separate convection cells.

LA-ICP-MS-measurements using the 25-hour and 169-hour experimental glasses further confirm the chemical separation of different layers. Our results, especially the REE distribution, support the effectiveness of a double-diffusive similar convection in this system. DDC-driven fractionation seams to be effective for moderately high-silica magmas under high near-liquidus temperatures, before the onset of fractional crystallization, confirming that such a differentiation process may lead to layering in this system.