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Residence time analysis of the active volcanic systems of Ischia, Italy

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The Italian peninsula hosts numerous active and potentially high-risk volcanoes, therefore understanding their dynamics is fundamental for volcanic hazard assessment. Here we present a study on the active volcanic system of Ischia, whose products have a potassic affinity with a subduction-related signature.

Volcanic rocks are characterised by a continuous transition from trachy-basalt to trachyte and minor phonolite. Geochemical and radiogenic isotope (Sr, Nd, Pb, Hf) data are consistent with a closed-system, two-step crystal fractionation process: the first step, drives magma composition from trachy-basalt to moderately differentiated trachyte; the second step drives the magma composition to the more differentiated products (trachyte and minor phonolite) determining very low Sr (a few ppm) and high Rb (>500 ppm) contents due to extreme plagioclase and K-feldspar fractionation.

A number of these highly differentiated trachytes have, along with high Rb/Sr, anomalously high Sr isotope composition that cannot be justified by assimilation of crustal material.

This characteristic could be explained by ^{87}Sr in-growth in a long-lived magma chamber. To explore this hypothesis we carefully screened a number of evolved samples on which we analysed feldspar-glass pairs through Rb-Sr isotope dilution method. The extremely low diffusion coefficients of Sr in feldspars makes them perfect candidates to estimate the timing of crystallisation and, by inference, the magma residence time. The calculated crystallisation times are here discussed in terms of magma chamber dynamics.