Mixing, mingling and enclave crumbling in the post-Minoan dacitic magmas of Santorini volcano, Greece

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The post-caldera islets of Palea- and Nea-Kameni formed as a result of nine eruptive events from A.D. 46-47 to 1950 in the center of the Santorini Minoan caldera. The erupted products are represented by dacitic lava flows and domes hosting basaltic to andesitic mafic enclaves. Dacitic rocks have low porphyritic index that increases with time, whereas their degree of evolution decreases pointing to the composition of the mafic enclaves. Enstatite contents of pyroxene and anorthite contents of plagioclase decrease from mafic enclaves to host lavas. Sr isotopes systematically increase with time and toward the less evolved composition of lavas and mafic enclaves, whereas Nd isotopes decrease. Whole rocks and mineral separates of mafic enclaves from the younger events are more Sr-radiogenic than their host lavas, the opposite occurs in the A.D. 46-47 lavas and enclaves.

Mixing and mingling processes between dacitic and mafic magmas, along with crumbling of the mafic enclaves in the host lavas are responsible for the observed textural and geochemical characteristics of the dacitic host lavas. The variations of Sr-Nd isotopes with time in the enclave magmas seem to indicate assimilation of limestone from the basement by the most mafic magmas; this process is associated to new mafic magma inputs and femic phase crystallization. A shallow layered reservoir with dacitic magmas overlaying lower mafic magmas is supported by our data. Crystal fractionation and cumulitic processes affect the lower part of the plumbing system allowing further layering of the mafic magmas, generating the variable and complex textures shown by the mafic enclaves. Different portions of the layered reservoir were frequently and variably sampled during time, as testified by variable types, compositions and distributions of mafic enclaves in the different eruptions. All this allows us to suggest periodic arrivals of mafic magmas in the post-Minoan plumbing system of Santorini, also implying for a still active magmatic system whose behaviour needs to be fully evaluated, also in the light of the 2011-2012 unrest.

A novel 2D LA-ICP-MS data analysis and visualization solution

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Microscale mapping of geochemical data, both isotopic and trace elemental in nature, by LA-ICP-MS has become tremendously popular in recent years [1]. Typically, such maps are produced by continuously analyzing the elements of interest while rastering a laser over an area and periodically monitoring gas blanks and standards. In order to properly interpret the resulting data, sophisticated processing, visualization and analyses are usually required. Although software packages exist to help with the aforementioned tasks [2,3,4], they tend to emphasize data processing and visualization, but quantitative analysis remains difficult.

Here we report the capabilities of a new LA-ICP-MS mapping tool that focuses on visualization and analysis by leveraging Iolite's [2] extensive data processing capabilities. It is written in Python and makes use of the matplotlib plotting library to produce publication quality figures. The key features include map-wide multi-phase internal standard corrections, extracting traverses, integrating arbitrarily shaped two-dimensional regions, and inspecting regions on the map *via* standard diagrams (*e.g.*, concordia or REE). Furthermore, the package can be integrated with Iolite to provide a convenient workflow.

Examples of zoned igneous phenocrysts from historic lava flows, zoned Precambrian pyrite of a sulfur reducing baceria origin, reaction textures in spinel peridotite, and complex zircon will be provided to demonstrate the functionality and strengths of this new mapping tool.

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