Were the Pre Lower Pumice 1, Lower Pumice 1 and Lower Pumice 2 eruption sequences sourced from the same magma reservoir, Santorini Caldera, Greece?

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The Santorini Archipelago of Greece preserves 650 kyr of volcanic activity, including 12 major explosive eruptions, which incorporate two 180 kyr mafic to silicic magmatic cycles, as well as the remnants of multiple lava-dome complexes, lava shields, stratovolcanoes and at least four caldera collapse events. The 3.5 ka Minoan eruption terminated the second magmatic cycle and was responsible for the destruction of a Minoan settlement at Santorini. The Pre Lower Pumice 1, Lower Pumice 1 (183.5 ka) and the Lower Pumice 2 (172 ka) eruptions ended the first magmatic cycle and are considered chemically similar to deposits of the Minoan eruption (dates from Keller et al. 2000). This could suggest cyclicity in magma generation processes.

The Pre Lower Pumice 1, Lower Pumice 1 and Lower Pumice 2 eruption deposits are variably exposed within the caldera cliffs and outer extremities of southern and eastern Thera. The Pre Lower Pumice 1 sequence is represented by 13 small volume pyroclastic fallout, ignimbrites and obsidian clast surge deposits, the latter resulting from the volcanic destruction of a lava dome. A paleosoil separates the Pre Lower Pumice 1 succession from the overlying pyroclastic fallout (LP1-A), ignimbrite (LP1-B) and lithic-rich lag breccia (LP1-C) deposits of the Lower Pumice 1 eruption. The Lower Pumice 1 eruption sequence is disconformably overlain by pyroclastic fallout (LP2-A), ignimbrites (LP2-B), phreatomagmatic ignimbrites with basal layer 1 ground breccias (LP2-C), and lithic-rich lag breccia (LP2-D) deposits of the Lower Pumice 2 eruption.

Crystal-poor, dacitic white pumice fragments represent the dominant juvenile product within each sequence. Subordinate abundances of transitional basaltic-dacitic banded and grey pumice fragments, in addition to mafic scoria, are also present. Chemically, these rock types depict two magma batches: (1) a dacitic (to rhyolitic) magma, and (2) a basaltic magma. The intrusion and subsequent mixing and mingling of the mafic magma with a cooling dacitic-rhyolitic magma, is considered responsible for the formation of both banded and grey pumice fragments within each eruption sequence. C1 chondrite normalised rare earth element (REE) plots, of dacitic white pumice fragments, depict uniformity in REE patterns within and between eruption sequences. This suggests an homogeneous source for each eruption and indicates the presence of a long lived magma reservoir. Episodic basalt magma injection into this reservoir may have triggered each eruption.