

Development of dacite magma from chemical and textural studies: Example from the Kameni Islands volcanic centre (Thera, Greece).

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The Kameni Islands volcanic centre has erupted dacite at least 13 times during the last 2000 years: the limited range in chemical composition ($\text{SiO}_2 = 64\text{-}68\%$) contrasts with the wide range in textures (plagioclase = 3-22%). Lavas are commonly glassy with abundant macrocrysts of plagioclase, some of which occur in loose clusters with relatively fine-grained cores. Most plagioclase crystals have simple zoning and belong to the same population. Enclaves are present but do not appear to have contributed significantly to magmatic diversity. Starting with the 46CE eruption SiO_2 initially rose until the explosive 726 eruption and then descended until the last eruption in 1950. Plagioclase abundances mirror this variation and are broadly correlated with decreasing SiO_2 and increasing Eu/Eu^* .

To better understand magma chamber processes, we determined the crystal size distributions (CSD) of plagioclase and correlated it with composition. CSDs are curved and have been modelled by adding two straight CSDs, 'large' and 'small', reflecting deep and shallow processes respectively. 'Large' CSDs show relatively little temporal variation in characteristic length, but their abundance increases with time. 'Small' CSDs become steeper with time suggesting progressively more rapid transport. Mass balance calculations show that compositional diversity can be accommodated by crystallisation of plagioclase macrocrysts from a series of dacite liquids that became less evolved with time.

We propose that there were 3 eruptive phases: During phase 1 (46-726) evolved dacite magmas were stored deep in the volcano, where minor amounts of plagioclase crystallised and coarsened. Phase 2 (1570-1928) magma crystallised more plagioclase in a cooler environment from less evolved dacite magmas. In the final phase (1939-1950) the composition of the dacite was the same as in phase 2, but the amount of plagioclase crystallisation was greater. The magmas also spent the shortest time in transit to the surface.