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Li, Be, B in dacites from Nea Kameni, Santorini Caldera (Greece)

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Dacite samples from four different lava flows on Nea Kameni were analysed for major (EMPA) and light element (SIMS) compositions in order to investigate processes during the crystallization of these arc magmas. Chemical zoning patterns across 29 plagioclase, 9 clinopyroxene, and 8 orthopyoxene phenocrysts, and one olivine crystal, along with spot analyses of the generally fine-grained matrix were obtained.

Five types of plagioclase phenocrysts were identified. *Type 1* crystals are normally zoned in terms of An content. Li, Be, B increase from core to rim, with values of 6.6-7.6 μg/g, 0.37-0.75 μg/g, and 0.10-0.18 μg/g, respectively. *Type 2* crystals display slight oscillatory variations in An content accompanied by Li, Be, B values within the range 6.5-23.4 μg/g, 0.54-0.97 μg/g, and 0.11-0.21 μg/g, respectively. There are two subtypes, however. *Type 2a* has relatively flat light element concentration patterns, while 2*b* has Li concentrations drastically decreasing from core to rim, core concentrations in such case reaching 23.4 μg/g. *Type 3* crystals have inherited cores with relatively higher An content than the outer portions. Li, Be, B concentrations within the core increase from the central portion, with values of 5.3-9.6 μg/g, 0.31-0.60 μg/g, and 0.10-0.16 μg/g, respectively. Where the An content drops to lower values, Li, Be, B values are elevated, and gradually decline towards the rim. Be pattern is particularly discontinuous, characterized by values of 0.61-1.0 μg/g. *Type 4* plagioclase grains show complex patterns in major and trace element compositions, the fluctuations strongly signaling changing conditions in the magmatic system.

Clinopyroxene phenocrysts are of two types. *Type 1* have Mg# = 63-74, in various zoning trends. *Type 1a* grains show core-to-rim increases in light elements, with Li values of 2.4-13.7 μg/g. *Type 1b* grains have irregular to flat light element patterns, Li within a narrower range of 2.5-3.3 μg/g. Be and B in the two subtypes range within

0.10-0.27 μg/g and 0.11-0.22 μg/g, respectively. *Type 2*, of which only 1 crystal was analysed, has higher Mg# of 82 in the core, decreasing to 78 at the rim. Li, Be, B generally increase from core to rim, with values of 1.5-4.2 μg/g, 0.02-0.06 μg/g, and 0.06-0.13, respectively.

Orthopyroxenes have Mg# = 57-68 and are also of two types. *Type 1* grains exhibit slight core-to-rim increases in Li, Be, B, with values of 1.7-2.7 μg/g, 0.03-0.4 μg/g, and 0.09-0.18 μg/g, respectively. *Type 2* phenocrysts show core-to-rim decreases in Li, with rather elevated values of 5.7-15.6 μg/g. Be and B do not show systematic variations, and occur within the same concentration range as in Type 1 crystals.

The olivine phenocryst has a consistent Mg# of $\sim$78, except at the rim where it abruptly falls to $\sim$68. The abundances of Li, Be, B inversely mimic this pattern. Li values are 1.4-5.7 μg/g, Be is approximately at the detection limit with values of 0.001-0.006 μg/g, and B within 0.04-0.11 μg/g.

The phenocrysts show a complicated magmatic history for the dacites. Variations in major and trace element patterns signal changes in the system which may be due to assimilation of older material, entrainment of previously crystallized phases into the convecting magma, magma mixing or degassing. Derived partition coefficients point to the incompatible nature of Li, Be, B in all major phases of these rocks. Core-to-rim increase in trace element concentrations is expected of incompatible elements, but the deviations from this trend suggest complexities not only in magmatic conditions but also in the behaviour of the different elements in the different minerals. Decline of incompatible element concentrations towards the rim, especially of Li, is generally interpreted to suggest degassing of the magma during crystallization. Detailed interpretation of the data at hand would elucidate on some of the intricacies of the Nea Kameni dacitic system.