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In situ ion-microprobe determination of trace element partition coefficients for hornblende, plagioclase, orthopyroxene, and apatite in equilibrium with natural rhyolitic glass, Little Glass Mountain Rhyolite, California

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Abstract

Partially crystalline hornblende gabbro inclusions from the Little Glass Mountain Rhyolite contain euhedral plagioclase, orthopyroxene, hornblende, and apatite crystals in contact with interstitial rhyolitic (71–76% SiO_2) glass. Textural and mineral compositional data indicate that the gabbros crystallized sufficiently slowly that surface equilibrium was closely approached at the interface between crystals and the liquid. This rare occurrence represents a natural dynamic crystallization experiment with a "run time" that is not realistically achievable in the laboratory. SIMS analysis of mineral rim-glass pairs have permitted the determination of high-quality, equilibrium trace-element partition coefficients for all four minerals. These data augment the limited partition coefficient database for minerals in high-SiO_2 rhyolitic systems. For all minerals, the D values are consistent with those anticipated from crystal-chemical considerations. These data further support a liquid SiO_2 control on the REEs (and presumably other elements) partitioning wherein D values systematically increase with increasing liquid SiO_2 content.

Keywords: Ion microprobe, rhyolite glass, trace element, partition coefficient