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Trace-element partitioning between plagioclase, alkali feldspar, Ti-magnetite, biotite, apatite, and evolved potassic liquids from Campi Flegrei (Southern Italy)

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Abstract

Partition coefficients ($^{Min/L}D$) for a series of geochemically relevant elements have been calculated from combined EMP/LA-ICP-HRMS analyses of plagioclase, alkali feldspar, Ti-magnetite, biotite, apatite, and trachytic/trachyphonolitic melt pairs in selected Campi Flegrei rocks. $^{Pl/L}D$ and $^{Kfs/L}D$ values are generally very low for most of the trace-elements but Sr, Ba, and Eu. $^{Kfs/L}D$ for the latter elements record a systematic increase as the melt composition changes from trachyte to trachyphonolite, likely due to increasing structural compliance of the sanidine in the trachyphonolites related to larger Na/K values. Conversely, $^{Kfs/L}D$ values for transitional, highly charged incompatible elements (e.g., LREE) decrease from trachyte to trachyphonolite, possibly in response to the decrease of melt polymerization. $^{Min/L}D$ values for titanomagnetite generally decrease with the increasing melt evolution, the highest values being those measured for Ti, V, and Sc. Ti, Ba, Sc, Rb, Nb, Ta, and V are compatible in biotite in equilibrium with trachytic melt, whereas Cs, Sr, and Pb are incompatible and REE are strongly incompatible, as supported by the extremely low $^{Bt/L}D_Y$ (0.003–0.008). Partition coefficients for apatite and trachyphonolitic glass pairs are high for Sr, REE (particularly MREE), and Y, large for Th, U, and V, generally low for HFSE, and variable for other LILE. The comparison of measured $^{Min/L}D$ values for Campi Flegrei trachytes/trachyphonolites with other sets of partition coefficients reported in literature for evolved systems suggests that a reliable data set for magma evolution modeling requires: (1) a thorough preliminary selection of natural samples; (2) the adoption of accurate microanalytical techniques; (3) the direct measurement of $^{Min/L}D$ values for each specific melt composition.

Keywords: Campi Flegrei, partition coefficients, plagioclase, alkali feldspar, Ti-magnetite, biotite, apatite, LA-ICP-HRMS