

Trace element partitioning between clinopyroxene and alkali basaltic melts: investigation at high pressure on a composition from the Campi Flegrei Volcanic District (Italy)

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Clinopyroxene is a common mineral and one of the most important constituents of igneous rocks. It has relatively high concentrations of most trace elements and it is, therefore, useful to study various processes including cooling rates, mantle melting, fractional crystallization and time scales of crystal residence in magma chambers. In this study, we present new experimental data on partition coefficients for trace elements between clinopyroxenes in equilibrium and in disequilibrium with a K-basaltic composition from Procida island (Campi Flegrei Volcanic District; CFVD). The experiments were carried out at 800 MPa as a function of temperature (1080-1250 °C) and time (0.25-9 hours). Moreover, for comparison we report the trace element concentrations of some natural clinopyroxene phenocrysts of some K-basaltic scoria clasts from Procida island. Variations of the partition coefficients were found as a function of the temperature, time, growth rate and the Al₂O₃ content in clinopyroxene. These variations are both positively and negatively correlated: for instance, D_{Cr} is positively correlated with time increasing from ~5 to ~60 with increasing time from 0.25 to 9 h, while D_{Gd} is negatively correlated decreasing from ~1 to ~0.5 with increasing time. Or even the variation with Al^{IV} is positive for almost all D except for D_{Sr} and D_{Ba} that instead decrease increasing Al^{IV}.

Finally, some representative trace elements were used to constrain the crystal residence times in the deep reservoir of the CFVD, obtaining estimates that are comparable with those available in literature for the Campi Flegrei.