Experimental constraints on the formation of basanites-phonolite series (Cumbre Vieja, La Palma)

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We present new results of high pressure crystallization experiments using primitive PB (14% MgO) and evolved EB (9% MgO) basanites and tephriphonolite TP (3% MgO), representing three differet evolutionary stages of the Cumbre Vieja (CV) volcano. All runs were conducted in an IHPV at 700, 550, 400 and 200 MPa, between 1175-950°C under H_2O-CO_2 fluid saturated conditions ($X$$H_2O$ varied between 0-1) and in the range of fO_2 between FMQ and FMQ+3.3.

The natural *basanitic* mineral assemblage *Ol+Cpx+Sp*, was reproduced for both PB and EB at 700 and 400 MPa, 1150-1100°C, 0.7-2.9% H_2O in the melt and at 550 and 400 MPa, 1175-1125°C and 1.5-2.7% H_2O respectively. Mineral association *Cpx+Krs+Pl+Mt+Ap* observed in natural *tephriphonolite* was reproduced in our experiments at 400 and 200 MPa, 1000°C and 0.6-0.7% H_2O in the melt. All these natural mineral assemblages and basanite-phonolitic trend of residual liquids have been reproduced in the range of fO_2 between FMQ and FMQ+1. More oxidized conditions were resulted in extensive *Mt* crystallization leading to formation of *Qtz*-normative residual liquids instead of following the *Ne*-normative trend. *Tephritic* residual melts in our experiements resembled the natural CV compositions only in runs where proportion of *Cpx* in solid phase was below 30%. Thus, variations of CaO and total alkalis in natural tephritic lavas can be explained by different proportions of *Cpx* and *Krs* which, in turn, strongly depend on aH_2O and T. At low aH_2O and high T *Cpx* predominates over *Krs* in solid phase and this results in stronger CaO depletion and alkalis enrichment in residual liquids. In contrast, at high aH_2O and low T, *Krs* is predominat in solid phase which results in depletion of total alkalis and higher CaO contents in the residual melt. Our results indicate that fractionation from basanites to tephrites might occur at pressures between 400 to 700 MPa. Pl crystallization in basanites is suppressed at 700 MPa, indicating that tephriphonolitic or phonolitic melts can only be generated at lower pressures or from a parent more evolved than basanite.

We conclude that the formation of tehriphonolitic and phonolitic magmas can also occur at pressures up to 400 MPa at least, which is in contrast to the relatively low pre-eruptive pressures obtained for phonolites from comparable systems.