Experimental determination of $D_F^{Hbl/Flu}$ in F-bearing systems at lower crust *P–T* conditions

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Fluorine is one of volatile elements (such as H, C, S, and Cl) during subduction zone magmatism. It is a useful geochemical tracer for volatile element transport. Here, we report partition coefficients of F between hornblende (Hbl) and aqueous fluids (Flu) from F-bearing experiments at 1 GPa. The solid starting materials contain 0.5% or 0.09% F. The initial water quantity is higher than solid material. After quench, fluorine concentration in aqueous fluids were determined by high pressure liquid chromatography (HPLC).

Together with previous F-rich system experiments, we find that F concentration in starting materials determine the absence or the presence of humite minerals and their species (clinohumite,Chu; chondrodite, Chd; norbergite, Nbg), whereas Hbl and fluids are always present (Summary table showing partition coefficients). As bulk F abandunce increases, F increases in all phases: Hlb (0.124 – 2.18 wt%), humite minerals (2.33 – 15.3 wt%), and fluids (32.5 ppm – 0.17 wt%).

$[F]^{Bulk}$	Phase assemblage	$D_F^{Hbl/Flu}$
5.0	Hbl-Nbg-fluid	10.5(8)
1.9	Hbl-Chd-fluid	19.7(1.3)
0.5	Hbl-Chu-fluid	98(25)
0.09	Hbl-fluid	38.1(1.5)

The values of $D_F^{Hbl/Flu}$ demonstrate that F prefers hydrous minerals to aqueous fluids under equilibrium. While F abundance in fluids increases with the higher F content in the system, F would be brought to deeper subduction zone with Hbl and humite minerals. $D_F^{Hbl/Flu}$ in a humite-absent assembly likely reveals specific F partitioning behavior, since F content in fluid is not buffered with humites. Alternatively, humites are potential reservoirs for excess F and indicators as F abundances in subduction zone slab flux.