PETROGENESIS OF PRAIRIE CREEK LAMPROITES: CONSTRAINTS FROM MELT INCLUSIONS AND HIGH-PRESSURE EXPERIMENTS.

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Crystalline, fluid and melt microinclusions in minerals of Prairie Creek (USA, Arkansas) lamproites have been studied in order to obtain information about composition and crystallization conditions of melts. It was shown that shallow-level crystallization proceeded at temperatures 1050-1150°C, while olivine, clinopyroxene and Cr-spinel were liquidus minerals. At this stage liquid was saturated by predominantly CO_2-H_2O fluid with CO_2 pressure being more then 4 kb. Silicate melts contain up to 14 wt.% of K_2O at about 7-9 wt.% MgO. Also typical are high concentrations of P, Ti, Ba, F and very high K/Al ratio. Based on the chemistry of homogenized melt inclusions the composition of the least evolved liquid have been calculated - (wt.%) SiO_2 44.1, TiO_2 4.4, Al_2O_3 4.5, FeO(t) 9.3, MgO 17.8, CaO 3.8, BaO 1.5, K_2O 9.9, Na_2O 2.4, P_2O_5 2.4. Similar liquid must have been in equilibrium with mantle residual assemblage. Synthetic material of such composition have been prepared and used in melting experiments conducted at 5-20 kb total pressure with pure H_2O, H_2O-CO_2 fluid as well as at fluid absent conditions. At all parameters the first crystalline phase is olivine. Further crystallization sequence depends critically on fluid regime:

dry	OL	-	OL+CPX		
H_2O	OL	-	OL+PHL	-	OL+PHL+CPX
H_2O-CO_2	OL	-	OL+OPX	-	OL+OPX+PHL

Assuming that natural fluid was predominantly a mixture of CO_2 and H_2O, we conclude that initial lamproitic melts were in equilibrium with phlogopite-bearing harzburgitic residua. A little amount of garnet probably was also retained in solid residua. Extrapolating phase equilibrium data the conditions of primary melt generation have been assessed - about 40 kb and 1400°C.