Study of silica-undersaturated magmas through the Kls-Nph-Di-SiO_2 system at 4.0 GPa under dry conditions.

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We experimentally investigated the Kalsilite–Nepheline–Diopside-Silica system, emphasizing the silica-undersaturated volume (Leucite–Nepheline–Diopside and Kalsilite–Nepheline–Diopside planes) at 4.0 GPa (~ 120km depth) and up to 1400°C at dry conditions, to better understand the influence of K_2O, Na_2O, and CaO in alkali-rich silica-undersaturated magma genesis. In the Lct-Nph-Di plane we determined the stability fields for kalsilite (Kls_{ss}), nepheline (Nph_{ss}) and clinopyroxene (Cpx_{ss}) solid solution, wollastonite (Wo) and sanidine (Sa), and three piercing points: (A) pseudo-eutectic Kls+Nph+Di+liquid ($Lct_{62}Ne_{29}Di_9$) at 1000°C; (B) Kls+Sa+(Di+Wo)+liquid ($Lct_{75}Nph_{22}Di_2$) at 1200°C, (C) pseudo-eutectic Kls+Di+Wo+liquid ($Lct_{74}Nph_{17}Di_9$) at 1000°C. Kalsilite stability field represents a boundary between ultrapotassic/potassic and sodic compositions. In the plane Kls-Nph-Di, we determined the stability fields for Kls_{ss}, Nph_{ss}, Cpx_{ss} and spinel (Spl). This plane has a piercing point in Kls+Nph+Di(±Spl)+liquid ($Kls_{47}Nph_{43}Di_{10}$) at 1100°C. Our data shows that pressure extends K dissolution in Nph (up to 39 wt%) and Na in Kls (up to 27 wt%), and that these solid solutions, if present, determinate how enriched in K and Na the generated magmas will be. Additionally, our data show positive correlation between K_2O and SiO_2 concentration in experimental melts, negative correlation between CaO and SiO_2 and no evident correlation between Na_2O and SiO_2.