Carbonatite/Lamproite liquid imissibility in the Earth's mantle through the Nefeline-Diopside-Kalsilite ± CO_2, CH_4, H_2O diagram

CONCEIÇÃO, R.V.[1,2*]; MARCON, V.H.[1]; SOUZA, M.R.W. [1,2], CARNIEL, L.C.[1,2]; QUINTEIRO, R.V.S.[1,2]; ROVANI, P. [1,2]; MIZUSAKI, A.M.P.[2]; SPITZENBERGER, M.S.[1]

[1]LAGEPE - Universidade Federal do Rio Grande do Sul, Instituto de Geociências, Porto Alegre, RS, Brazil
[2]PPGGEO, UFRGS, IGeo, Porto Alegre, RS, Brazil
[*]Corresponding author: rommulo.conceicao@ufrgs.br

The presence and speciation of volatile C-H-O elements in the silicate systems play an important role in the genesis of magmas on the Earth's mantle, due to the fact that these elements, mainly in the form of H_2O, CO_2, CH_4 and C_xH_y, decrease the solidi temperatures of source rocks, making magmatism possible in Earth's present day thermal conditions [1]. Among those elements, carbon is the only element that changes its valence according to the oxygen fugacity (fO2) conditions of the environment, resulting in different speciation, as: CO_3^{-2}, CO_2, $C_{graphite/diamond}$, CH_4 or heavier hydrocarbons. In the present work, we are determining phase stability of minerals, water, CO_2 and CH_4 in the system Nefeline-Kalsilite-Diopside. Our experiments are conducted under 4.0 GPa and temperatures up to 1300°C, using a 1000 tonf hydraulic press coupled with toroidal chambers. Preliminary experiments performed at 1300°C and 4.0GPa (initial composition in the Olivine-Quartz-Kalsalite/Nepheline system: 40mol% Ol90, 40mol% Nph50Kls50 and 20mol% Qz, $P_{H_2O,CO_2}=P_{total}$) resulted in the formation of forsterite (Fo90) in equilibrium with phlogopite (Phl), melt and volatile phases (CO_2 and CH_4). Closer to the Diopside vertice, the addition of CO_3 to the sample resulted in a imisibility of a carbonatitic and a silicatic melt, in which the carbonititic melt is enriched in sodium, while the silcate melt is enriched in potassium. Appart from that, experiments in different parts of the diagram suggest compositions from nephelinite-kalsilitite to lamproites composition for the silicate melt in equilibrium with diopside (solid solution with omphacite) and phlogopite. This work is a continuation of previous work in the anhydrous diagram and future works will provide the addition of CH_4 as the volatile phase.

References:

[1] J.F. Kenney, V.A. Kutcherov, N.A. Bendeliani, V.A. Alekseev. PNAS 99, 10976-109981 (2002).