American Mineralogist, Volume 108, pages 709–718, 2023

The $NaCl\text{-}CaCO_3$ and $NaCl\text{-}MgCO_3$ systems at 6 GPa: Link between saline and carbonatitic diamond forming melts

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Abstract

The frequent occurrence of chlorides and carbonates in the form of microinclusions of melts or high-density fluid (HDF) in diamonds and igneous minerals of kimberlites worldwide generates genuine interest in their phase diagrams under pressure. Here, we present the first experimental results on the phase relations in the $NaCl\text{-}CaCO_3$ and $NaCl\text{-}MgCO_3$ systems at 6 GPa in the range 1000–1600 °C performed using a multi-anvil press. We found that both systems have the eutectic type of phase diagrams. The subsolidus assemblages are represented by halite + aragonite and halite + magnesite. Halite-aragonite eutectic is situated just below 1200 °C and has a composition of 40 wt% NaCl and 60 wt% $CaCO_3$. Halite-magnesite eutectic is located at 1300 °C and has a composition of 72 wt% NaCl and 28 wt% $MgCO_3$. The halite melting point was established at 1500 °C. Complete miscibility between carbonate and chloride liquids was observed up to 1600 °C. The results support the hypotheses that saline HDF is either a low-temperature derivative or precursor of mantle carbonatite HDF. The data also do not exclude an alternative hypothesis, according to which saline HDF are formed as a result of the reduction of the carbonate component of chloride-containing carbonatite melts to diamond.

Keywords: Chloride-carbonate, saline HDF, carbonatitic HDF, *T-X* diagram, Earth's mantle