

LETTER

Merwinite in diamond from São Luiz, Brazil: A new mineral of the Ca-rich mantle environment

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ABSTRACT

Diamonds from Juina province, Brazil, and some others localities reveal the existence of a deep, Ca-rich carbonate-silicate source different from ultramafic and eclogite compositions. In this study, we describe the first observation of merwinite ($\text{Ca}_{2.85}\text{Mg}_{0.96}\text{Fe}_{0.11}\text{Si}_{2.04}\text{O}_8$) in a diamond; it occurs as an inclusion in the central growth domain of a diamond from the São Luiz river alluvial deposits (Juina, Brazil). In addition, the diamond contains inclusions of walstromite-structured CaSiO_3 in the core and $(\text{Mg}_{0.86}\text{Fe}_{0.14})_2\text{SiO}_4$ olivine in the rim. According to available experimental data, under mantle conditions, merwinite can only be formed in a specific Ca-rich and Mg- and Si-depleted environment that differs from any known mantle lithology (peridotitic or eclogitic). We suggest that such chemical conditions can occur during the interaction of subduction-derived calcium carbonatite melt with peridotitic mantle. The partial reduction of the melt could cause the simultaneous crystallization of Ca-rich silicates (CaSiO_3 and merwinite) and diamond at an early stage, and $(\text{Mg}_{0.86}\text{Fe}_{0.14})_2\text{SiO}_4$ olivine and diamond at a later stage, after the Ca-Mg exchange between carbonatite melt and peridotite has ceased. This scenario is supported by the presence of calcite microinclusions within merwinite.

Keywords: Merwinite, diamond, Earth's mantle, calcic lithology, carbon