

Observation and interpretation of paramagnetic defects in Brazilian and Central African carbonados

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ABSTRACT

Electron paramagnetic resonance (EPR) and photoluminescence (PL) spectroscopies have been used to study Brazilian and Central African carbonados. We report the first observation of the N_2V^+ and N_2^+ nitrogen defect centers in carbonados. The fact that Brazilian carbonados contain the N_3V (previously reported), N_2V^+ , and N_2^+ defects, the formation of which requires complicated aggregation of nitrogen, indicates histories at elevated temperature and pressure. The observation of both the radiation-induced A1 defect, which has an annealing temperature of 700 K, and radiation defects containing two and/or five vacancies, suggest a continuous process of the formation and transformation of radiation defects in the carbonado under variable pressure and temperature conditions while in the upper mantle. The temperature at which these defects are formed varies from 300 to 1500 K. In addition we report a hydrogen-containing defect labeled H1, previously only observed in synthetic diamonds prepared by chemical vapor deposition. Together with the previously reported light carbon isotope ratio, the results of this study confirm the hypothesis that carbonados are derived from hydrocarbon source material.