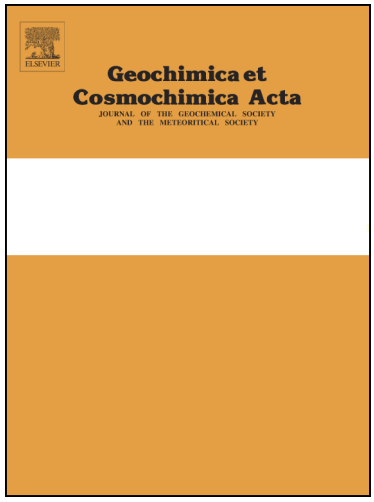

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Nitrogen isotope systematics and origins of mixed-habit diamonds

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Abstract

Nitrogen isotope values from mantle diamonds are a commonly used tracer in the quest to track volatiles within the Earth's mantle through deep time. Interpretations of this isotope data are valid so long as stable isotope fractionation processes in the mantle are understood. The fractionation of nitrogen isotopes between {111} and {100} growth sectors is well documented for high-pressure high-temperature (HPHT) synthetic diamonds, but there is little data on whether it also occurs in natural mixed-habit diamonds. We present 91 in-situ nitrogen isotope ($\delta^{15}N$) measurements, along with carbon isotope ($\delta^{13}C$) values and nitrogen abundances [N], obtained from three mixed-habit diamonds by secondary ion mass spectrometry (SIMS). While the well-documented enrichment of nitrogen concentrations in octahedral sectors compared to contemporaneous cuboid sectors is observed, a similarly clear disparity is not obvious in the $\delta^{15}N$ data. Whereas HPHT synthetic diamonds exhibit ^{15}N enrichment in the {100} sectors by ~ +30 ‰, the mixed-habit diamonds studied here show enrichment