Carbon isotopes of nephrite-hosted graphites: Implications for the origin discrimination of nephrite jade

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Nephrite jades are widely used historically and presently in China, and the provenance studies on nephrite jade are of great importance in gemology as well as archeology. Graphites, which is a sensitive indicative mineral for the geological environment it originated, are commonly hosted in dolomite-related nephrite jades. Comparative study on multiple occurrences will contribute to understanding the mineralization of nephrite jades and the genetic relationship between graphites and their host nephrite jades.

In this study, secondary ion mass spectroscopy (SIMS) was applied for the in situ carbon isotope analysis of graphites in host nephrite jades from five dolomite-related deposits in China (Hetian, Yutian, Xiuyan, Geermu and Mazongshan). Graphites of all the samples studied are well-ordered with nearly perfect crystallinity, and clusted in three patterns: stripped, star-like and nebulous. SIMS results show that carbon isotopes ($\delta^{13}C$) of graphites hosted in nephrite jades range from -8.2‰ to 2.0‰, with surprisingly narrow range for each deposit and tiny overlap between the deposits (the $\delta^{13}C$ are -8.2‰ ~ -6.8‰, -4.8‰ ~ -3.6‰, -7.0‰ ~ -5.7‰, -5.6‰ ~ -4.4‰ and 0.4‰ ~ 2.0‰, respectively). These data indicate carbonates source of carbon for the nephrite-hosted graphites and the light isotopic signatures of graphites from Hetian and Xiuyan suggest they are slightly affected by biogenic carbon. Furthmore, the carbon isotopes differences of graphite enclaves indicate a great posibility for discriminating ancient nephrite jades from different occurrences.

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