

Kyanite inclusion in eclogitic macrodiamond from Hunan placer diamond deposit

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Eclogitic diamonds (E-type) often have crustal inclusions related to subduction, which are important to explore the interaction between the deep evolution process of the lithospheric mantle and shallow crust. Given the rarity of the diamonds (Dia) along with a small percentage of E-type relative to peridotitic diamonds (P-type), research work focusing on them is usually limited.

The Dia from Yuan River in Hunan are mainly placer origin and 80% of them belong to gem-grade macrodiamonds. Besides, their E-type Dia constitute a large proportion equal to P-type. The discovery of featured crustal mineral inclusion, kyanite (Ky), thus provides a good opportunity to discuss the genesis of E-type Dia and lithospheric mantle evolution of the Yangtze Craton (YC).

Here we elaborate on the mineralogy and geochemical composition of the Ky inclusion in Dia from Yuan River placer deposit. CL and DV images show that the Dia bearing Ky inclusion has the typical growth texture $\{111\}$. The Ky inclusion is located nearby the center of the successively homogeneous growth zonation of the Dia, indicating the Ky crystal was captured at the initial stage of Dia formation, following by Dia growing slowly. Raman spectroscopy display obvious spectral peaks of the Ky, consistent with the faceted cut Ky gems. The large size of the Dia (max 4.27mm) containing the Ky is in the range for Dia of mantle genesis, in contrast to the Dia of crustal origin that are microdiamonds with $<20\mu\text{m}$ across. Whilst the Ky inclusion showed geochemical composition of high Si, Al, low Fe, Cr contents with high Ga and low Sr, Zr concentrations, similar to the high-pressure crustal mineral Ky. It was also reported that Archean basement was widespread in YC but unexposed to the surface (old deep crust). Combined with significant research on Paleo-Neoproterozoic subduction and crust-mantle recycling in YC, the occurrence of the Hunan Ky inclusion in Dia therefore shows the incorporation of material of crustal provenance with the mantle. For Dia with Ky inclusion growing in a stable condition and to be preserved in a subduction setting, its emplacement to the surface must be rapid and must occur before the slab heats up following subduction cessation.