

The subduction signature beneath the Yangtze Craton: Constraint from the C-O isotope of diamond and its inclusions

MR. DING YONGKANG, PHD¹, XIAOQIN DENG², FU BIN³, ZHI-CHAO LIU⁴ AND QIU ZHILI⁵

¹School of Earth Sciences and Engineering, Sun Yat-Sen University

²Guangdong Academy of Sciences, China

³Research School of Earth Sciences, Australian National University

⁴School of Earth Sciences and Engineering, Sun Yat-sen University

⁵School of Earth Sciences and Engineering, Sun-Yat-Sen University

Diamonds and their inclusions, particularly those of eclogitic type, serve as unique probes for deciphering both mantle-crust interactions during subduction and source heterogeneity within the sub-continental lithospheric mantle (SCLM). The Yangtze Craton hosts abundant alluvial eclogitic diamonds of enigmatic origin, whose genetic linkage to ancient subduction processes remains unresolved. Here, we report two eclogitic diamonds from the Yuan River placer deposits, containing kyanite and coesite inclusions respectively, which provide direct evidence for subducted crust material transport into the SCLM beneath Yangtze Craton. Oxygen isotope compositions of kyanite ($\delta^{18}\text{O} = 6.63\text{--}7.50\text{‰}$) and coesite ($\delta^{18}\text{O} = 7.32\text{--}7.98\text{‰}$) exhibit signatures diagnostic of ocean crust, while diamond carbon isotopes ($\delta^{13}\text{C} = -24.3\text{‰}$) indicate derivation from organic carbon sources. Additionally, P-T estimates of the inclusions constrain equilibration conditions to 6.1–8.5 GPa and 929–977°C, implying the occurrence of a cold subduction process. These findings collectively demonstrate the subduction of crustal protoliths into diamond-stability domains through cold subduction. Integrated with Neoproterozoic subduction records preserved in the Jiangnan Orogen, we suggest that northwestward slab subduction during the amalgamation process of the Yangtze Craton and Cathaysia Block facilitated the transport of supracrustal materials to cratonic mantle depths.

