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Role of lithospheric mantle-derived carbon on Early Cretaceous giant decratonic gold mineralization in the eastern North China Craton

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Plenty of giant gold deposits are widely distributed in the eastern North China Craton, which formed during Early Cretaceous decratonization triggered by subduction of the Paleo-Pacific oceanic plate [1]. Fluid inclusion of gold deposit observations show that the ore-forming fluids mainly consist of H_2O + CO_2 + NaCl, indicating an important role of CO_2 in gold mineralization [2]. In addition, geochemical and isotopic evidence suggests that subcontinental lithospheric mantle (SCLM)-derived magma carries ore-forming materials (including Au, S, CO_2 and other metals), which have contributed to gold mineralization. However, it is little known about the carbon release related to magmatism from the SCLM deduced by decratonization processes. Here we show that the primary melt of Early Cretaceous Yixian basalts contained abundant CO_2 (about 0.6 wt.%), through investigating melt inclusions trapped in olivine crystals [3]. The melt inclusions are alkalic and chemically distinct from their sub-alkalic host basalts, which could be explained by that the primary alkalic melt was reactively modified during magma ascent in the SCLM. The primary melt has geochemical characteristics consistent with partial melting of a veined carbon-rich amphibole pyroxenite source in the SCLM formed metasomatically during circum-craton subduction events. The findings highlight that the carbon introduced into the cratonic SCLM during subduction could be subsequently reactivated and transferred to the crust and atmosphere through decratonization-related magmatism, which might represent a major process regarding the SCLM in regulating the terrestrial carbon cycle. Importantly, the SCLM-derived CO_2-bearing magma is conducive to transport gold and other ore-forming metals from the mantle source to shallow crustal levels, which induces giant gold mineralization during Early Cretaceous decractonization of the North China Craton.

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