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Gold endowment of the metasomatized lithospheric mantle for giant gold deposits: Insights from mafic magmatism

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Gold is one of the most important economic commodities. The metasomatized subcontinental lithospheric mantle (SCLM) is increasingly proposed to play a key control in the formation of giant gold (Au) deposits [1, 2]. However, the extent of Au enrichment in metasomatized lithospheric mantle and the Au contents of its derivative partial melts remain poorly constrained. The giant lode Au deposits (~ 120 Ma, >5000 tons) in the eastern North China Craton (NCC), with mantle-dominated volatiles in auriferous fluids, are an ideal locality to assess the Au endowment of metasomatized SCLM which may serve as the source of Au [3, 4]. Here we presented Au, Cu, S and platinum-group element contents of the metasomatized SCLM-derived lamprophyres and basalts that formed slightly before Au mineralization [5, 6]. These magmatic products could be more homogeneous and representative to reflect the mantle source than mantle peridotites themselves. However, these volatile-rich lamprophyres and basalts display variable and low Au (1-4 ng/g) and Cu contents, regardless of degrees of melting. Combined with modelling and reported Au contents of mantle peridotites (<1 ng/g) in the NCC [5], these results further indicate that the metasomatized SCLM beneath the eastern NCC is not significantly rich in Au. Thus, the anomalous Au enrichment of SCLM by mantle metasomatism is important but may not be the first-order factor in the formation of giant Au deposits. However, we remain to emphasize the importance of metasomatized SCLM in the formation of giant Au deposits, but metasomatic volatiles which enables the efficient release of Au from the mantle source and promotes later Au transportation and precipitation may exert a primary control [7, 8].

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