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Genesis of the Paishanlou gold deposit, North China Craton, China: Constraints from S-Pb-C-O isotope geochemistry

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The Paishanlou gold deposit (>50 t Au) is located at the northern margin of North China Craton. It is hosted in the Neoarchean metamorphic rocks of the Jianping Group and mainly controlled by ENE-NW-trending ductile shear zones. Gold mineralization is closely associated with a typical greenschist facies alteration assemblage of sericite+chlorite+calcite+biotite+quartz. The genesis of the Paishanlou gold deposit are ambiguous, with two interpretations haveing been suggested: an orogenic gold deposit or a magmatic-hydrothermal deposit. The $\delta^{34}S_{V\text{-}CDT}$ values of main ore-forming stage pyrites are between 0.5‰ and 7.3‰, which are similar to the pyrites from the metamorphic wall rocks (0.27‰~4.77‰), but slightly lower than the pyrites in the Late Mesozoic granitoids (6.03‰~10.84‰). The $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ values of auriferous sulfides range within 16.585~18.432, 15.299~15.698 and 37.159~38.982, respectively, which lies between the Archean metamorphic rock, the Proterozoic dolomitic marble and the Late Mesozoic granitoids, implying that the metal may derive from the the upper mantle and lower crust reservoirs. $\delta^{13}C_{V\text{-}PDB}$ and $\delta^{18}O_{V\text{-}SMOW}$ values of hydrothermal carbonate minerals are -6.7‰~-2.1‰ and 12.2‰~16.7‰ respectively, indicating a major mantle or metamorphic carbon source. The S-Pb-C-O isotope signatures indicated that the ore-forming materials originated mainly from multiple wallrocks and the upper mantle, supporting the Paishanlou gold deposit belongs to the orogenic gold deposit. Thus, we suggest that the last ductile shear event (130~120 Ma) around the NE-striking shear zone which is related to lithosphere thinning and the destruction of the North China Craton has resulted in the formation of the Paishanlou orogenic gold deposit.