Deciphering the Role of Remobilisation in the Formation of High-Grade Gold Deposits

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High-grade native gold mineralisation in gold deposits is often attributed to secondary enrichment processes, such as gold remobilisation. Evidence for such processes is typically indirect and often restricted in elucidating their spatial extent and their relative contribution to the overall gold endowment. In this study, we investigate the trace element composition of native gold coupled with the characterisation of pyrite textures and chemistry to gain insights into the formation of native gold at the high-grade Jundee gold deposit. This innovative approach reveals gold mineralisation was polyphased within a single veining phase. The main mineralisation event is hosted in quartz-carbonate shear vein (VJ2B), characterised by the early formation of invisible gold associated with oscillatory zoned pyrite (PyVJ2B) mantles that formed from an As-rich fluid. Subsequent PyVJ2B growth was characterised by the formation of As-poor rims surrounding the PyVJ2B mantles and the coetaneous deposition of extensive native gold during the same veining event (VJ2B). Native gold occurs in distinct habits, including native gold inclusions in PyVJ2B along with extensive native gold grains external to PyVJ2B. Differences between the trace element composition of native gold inclusions within PyVJ2B and native gold external to PyVJ2B indicate that not all native gold associated with the main mineralisation stage at Jundee formed via secondary enrichment processes and therefore manifest a primary introduction. Mass balance calculations further demonstrate that the latter introduction of native gold accounts for the high-grade nature of the Jundee deposit with limited contribution from remobilisation processes.