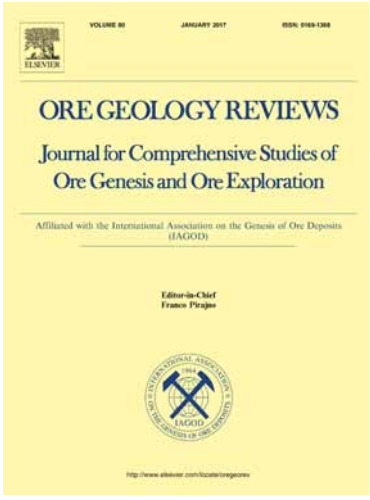

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Low temperature recrystallisation of alluvial gold in paleoplacer deposits

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Abstract

Detrital gold particles in paleoplacer deposits develop recrystallised rims, with associated expulsion of Ag, leading to the formation of Ag-poor rims which have been recognised in most placer gold particles around the world. Recrystallisation is facilitated by accumulation of strain energy as the gold particles are deformed, particularly on particle margins, during transportation in a fluvial system. The recrystallisation process ensues after sedimentary deposition and can occur at low temperatures (<40°C) over long geological time scales (millions of years). In the Otago placer goldfield of southern New Zealand, paleoplacers of varying ages contain gold with varying transport distances and these display differing degrees of rim formation. Narrow (1-10 μm) recrystallised rims with 0-3 wt% Ag formed on gold particles that had been transported <10 km from their source and preserved in Eocene sediments. Relict, coarse grained (~100 μm) gold particle cores have 3-10 wt% Ag, which is representative of the source gold in nearby basement rocks. Gold in the Miocene paleoplacers was recycled from the Eocene deposits and transported >20 km from their source. The gold particles now have wider recrystallised rims (up to 100 μm), so that some particles have essentially no relict cores preserved. Gold in Cretaceous paleoplacers have wide (~100 μm) recrystallised low-Ag rims, even in locally-derived particles, partly as a result of diagenetic effects not seen in the younger placers. Gold particles in all the paleoplacers have delicate gold overgrowths that are readily removed during recycling, but are replaced by groundwater dissolution and reprecipitation on a time scale of <1 Ma. The recrystallisation that leads to Ag-poor rim formation is primarily related to the amount of deformation imposed on particles during sedimentary transport, and is therefore broadly linked to transport distance, but is