Microchemical Signature of Placer Gold Nuggets from the Central Iberian Zone (Spain)

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Gold placers are abundant and have been intensively surveyed in western Iberia since antiquity. Three Cenozoic gold placers covering Neoproterozoic-Lower Paleozoic basement have been revealed: Salvatierra de Tormes (ST), Santibáñez el Alto (SA), and Casas de Don Pedro (CSDP). We have combined microchemical and inclusion analysis and morphology of gold nuggets to define gold signatures and relationships with primary sources and infer mineralization style.
Allotriomorphic nuggets have been identified in the placers, and gold with crystal faces and gold-bearing quartz fragments have been found in CSDP. Four different gold types have been defined: core (T1), gold-rich rim (T2), fine-grained gold in Fe-oxy-hydroxides (T3), and "mustard" gold (Au+Sb-Pb-Fe-oxides) (T4). Nuggets from ST-SA are zoned Au:Ag alloys (T1: 8.7 Ag wt%; T2: 0.6 Ag wt%), nuggets from CSDP only show fine T1 (0.6 Ag wt%), and all nuggets present late T3 (<1.0 Ag wt%) filling gold embayments. Filonian quartz includes an Au:Ag:(Cu) T1 alloy (13.5 Ag wt%), Fe oxy-hydroxides with Sb-Pb altered minerals (oxyplumboromeite), and secondary fine-grained gold (T4: Au:Ag, 5.3 Ag wt%).
T1 texture and composition in nuggets from ST-SA and gold in quartz from CSDP suggest hydrothermal origin, high variability of Ag (<5.0-15.45 wt%), and sulphides/sulphosalts microinclusions. Secondary Ag-leaching led to gold refinement (T2) that together with dissolution-precipitation mechanisms and oxidation of Fe^{2+} induced precipitation of T3. Finally, T4 reflects an early alteration of the primary mineralization, including reprecipitation of fine-grained gold and alteration of Sb-Pb phases.
Old mining works in primary mineralization observed in CSDP indicate it is a proximal placer (Plio-Pleistocene glacis). ST-SA deposits have similar characteristics pointing to a stage of relative dispersion from the source, being considered fluvial “trunk” placers (Eocene-Oligocene/Upper Pleistocene). Gold fingerprint is complex but evolves coherently from primitive-proximal deposits (CSDP) to more transported ones (ST, SA) providing a valuable tool for exploration.