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Unravelling the origin of placer gold: A case study on the largest Roman gold mining sector of NW Spain (Jamuz, León)

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NW Iberia hosts a substantial number of mineral resources. Among them, gold (Au) acquired particular relevance since Antiquity, representing one of the largest Roman Au mining provinces in Europe. While primary deposits associated with orogenic Au have been widely studied in the past years, the Plio-Quaternary *Raña* Au-bearing placer deposits of the western Duero Basin have received little attention. Besides, the different morphology of Au particles suggests complex processes that may have been responsible for the secondary formation of colloidal particles and Au growth grains from complex geochemical soil interactions and biological activity. In this context, exploring the mechanism by means these secondary deposits developed may contribute to understanding the source of Au (extrinsic or intrinsic factors that rule in within *Raña* deposits) and the formation of potential mineral exploration sectors. This paper outlines the geochemical analysis of a Cenozoic *Raña*-like deposit in the Jamuz valley (León), where the source of Au and the main characteristics are established. The correlation matrix showed notable relationships between Au, Fe, Na, K, Ca, Pb and As, among the most important. High values in Fe and As provides direct evidence of Au precipitation. Likewise, a non-linear correlation was found between Au-Na, and Au-Ca, suggesting a direct link to soil formation processes. Finally, the presence of apparent differences in grain roundness and the particles' characteristics ranging from monomineral angular Au to polymineral rounded-shaped particles points towards a complex process affecting the *Raña* deposits. The ubiquitous rubefaction and top-bottom leaching activity produced during rainwater percolation aided by the extreme drainage affecting this conglomeratic formation have often been argued to be responsible for the transformation of mineral phases in soils. The presence of secondary silicification processes and pH drop due to biological reactions (i.e.,

presence of P) may have been a triggering mechanism for digestion and reprecipitation of Au colloids in these sediments. Our results have outstanding implications on the mechanisms that may determine the Au enrichment of certain levels within the *Raña* deposits of the western Duero Basin.

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