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Quantitative texture analysis of alluvial gold: primary and secondary signatures

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The origin of gold nuggets (Au�Ag alloys) is not completely understood. They crop out in placer deposits, potentially derived from a primary source (hydrothermal/magmatic). Meteorization, erosion and transport of primary gold deposits result in the liberation of a variety of particle size. Recent investigations suggest that both primary and secondary microstructural features may be preserved and could be related to deformation during transport, recrystallization and primary formation. Besides, the contribution of biological mechanisms (biomineralization) may have played an important role during secondary growth in some nuggets. In many cases, there is no clear evidence to distinguish between supergenic and hypogenic gold, so texture information could be excellent information to constrain the origin. Besides, it has been demonstrated that crystallography controls the de�alloying processes in gold nuggets. This mechanism, that transforms the primary Au–Ag alloys into pure gold by preferential dissolution of Ag along crystal boundaries, could be determined by variations on texture, a factor never explored before, which may explain the dispersion in de�alloying values in the same deposit.

In this case we have explored a selection of gold nuggets collected in the W sector of the Iberian Massif (Spain), representing the principal morphological types. As a non-destructive technique neutron diffraction appears as the technique of choice in this case. Beside, neutrons absorption is very low so that large samples could be investigated. Samples were analyzed in transmission at ILL (Grenoble) for texture. Quantitative texture and gold crystallinity was calculated using Rietveld method as implemented in Maud software (EWIMV). Mono- and polycrystalline nuggets and alloy composition were clearly identified in each particle with this technique. Our results show a close correlation between the morphology (i.e. transport length) of the particle and the crystallographic results, particularly for fibrous and discoid shapes (i.e. Zingg, Corey shape factor), what could be used to develop better transport models (distance-to-bedrock sources) and understand multisource gold placer assemblages.