Significance of post-depositional alteration for the genesis of Witwatersrand-type gold based on the examples of the Jacobina and Moeda gold deposits in Brazil

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Summary

The Moeda and Jacobina deposits in northeastern Brazil are the economically most important known conglomerate-hosted gold deposits in South America. Their genesis has often been compared with that of the world’s largest known gold anomaly in the Mesoarchaean Witwatersrand Basin in South Africa. In contrast to the latter, very few studies have been carried out to date on the South American examples with partly conflicting results. Uncertainties existed with regard to metallogenesis and age as well as on the significance of post-depositional alteration. This project aims at overcoming these obstacles in our understanding.

Detailed field mapping of underground exposures of the auriferous Moeda Formation conglomerate and statistical analysis of the gold distribution therein revealed a strong sedimentological control on ore grade, with most of the gold being concentrated on top of an old erosion surface. Combined U-Pb and Lu-Hf isotope data obtained on detrital zircon grains from these deposits constrained the sedimentation age to 2.68 Ga and gave important information about possible source areas, indicating major reworking of older crust in the hinterland of the Moeda Formation’s depositional basin. Rutile grain analysis yielded atypically high REE and Th concentrations. In combination with U-Pb isotopic data, these data revealed a major metamorphic overprint combined with different stages/intensities of fluid-rock interactions at 2.25 Ga. Gold morphological studies revealed the presence of both hydrothermal gold and detrital gold micro-nuggets, which corroborate the notion of a modified palaeoplacer genesis. Mineralogical evidence from gold–tourmaline intergrowths on authigenic pyrite indicates that the transporting fluid was boron-rich but poor in aqueous sulfide species, at least at Moeda.

In contrast to Moeda, the Jacobina deposits experienced a higher degree of metamorphism and hydrothermal overprint, being located near a major thrust plane. Nevertheless, primary mineralogical and mineral chemical features remained preserved in places. Systematic difference in gold composition between different conglomerate units (reefs) and undoubtedly hydrothermal gold in cross-cutting veins, shear zones and intrusive bodies, attest to original placer deposits with variable provenance and subsequent syn-orogenic reworking of the ore.

Publications

Ferrífero of Minas Gerais, Brazil: New constraints from U–Pb–Hf isotopes in zircon and xenotime.
Precambrian Research 255, 96-108.


