## EMP and LA-ICP-MS Analysis of Pyrites from gold Reefs in the Witwatersrand Basin, South Africa

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The Witwatersrand Basin in South Africa is the world's largest gold-producing ore deposit (Frimmel et al. 2005). Three polished sections of gold ore from the Main, Beatrix, and Carbon Leader (CLR) reefs of the Central Rand Group (CRG) were analyzed for trace element contents (cobalt, nickel and arsenic) in various textural types of pyrite by electron microprobe (EMP - Museum of Natural History in Berlin) and LA-ICP-MS (Julius-Maximilians University Würzburg) analysis. Pyrite classification of textural varieties was done according to England et al.'s (2002) upper-level grouping: rounded detrital, porous round, and authigenic pyrites. The here investigated authigenic pyrites were subdivided into a compact and a porous variety with pores that either follow the crystallographic axes or are arranged in different zones which was already observed by Feather & Koen (1975). Pyrite grains differ from each other in their overall Co, Ni and As abundances. They cannot be chemically discriminated against each other in dependence of morphological type or reef stratigraphy. Meyer et al. (1990) came to a similar conclusion for the CLR and four other reefs. Their three pyrite types showed "similar ranges in Co and Ni contents [...] and cannot be distinguished one from the other in terms of their chemistry" (ibid). In the present study samples from the various analyzed reefs define a trend for the mean values of some trace elements. The highest As and Co average value were obtained for the Main Reef, the Beatrix Reef has the lowest Co and Ni mean values, and moderate As content and the CLR sample the lowest As values and a moderate Co value. Detrital pyrites from the Main and Beatrix reefs differ in their primary trace element contents related to their source areas. Partially they have complex internal zonation in As, Ni and Co and often these layers are truncated (cf. MacLean & Fleet 1989). Pyrites from the Main Reef may show a marginal narrow zone enriched in Co and As, often followed by another outermost zone with reduced Co-As contents. The shape of this growth zone is irregular with respect to primary growth zones. This suggests that the Co-As enriched zone was formed by dissolution-redistribution processes induced by a Co-As enriched fluid. At the outermost margins secondary growth zones may also be enriched in Ni, but these zones are generally separate from the Co-As enriched zones. This study demonstrates that trace element patterns of pyrites may help to reconstruct the provenance and post-depositional hydrothermal alteration of mineralized Witwatersrand sediments.

References

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