EMP and LA-ICP-MS analysis of pyrites from the Ventersdorp Contact Reef in the Witwatersrand Basin, South Africa.

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The Witwatersrand gold fields in South Africa are the world's most important gold producing province. The Ventersdorp Contact Reef (VCR) is an auriferous conglomerate horizon and economic ore body at the top of the Late Archean Witwatersrand Supergroup (Frimmel et al., 2005). The VCR lies on a major unconformity between underlying Witwatersrand Supergroup sediments and overlying Klipriviersberg volcanics of the Ventersdorp Supergroup and is the primary economic reef at Kloof Gold Mine, where the samples for this study were obtained. Pyrite is the most common sulfide mineral associated with gold in these samples and occurs in a number of different textural forms (Hallbauer, 1986; England et al., 2002b, Feather & Koen, 1975): (1) rounded, compact, (2) rounded, porous, including multipli zoned concretionary pyrites, and (3) euhedral authigenic pyrites. The authigenic type is by far the most common form in the VCR. Several pyrite grains from the Kloof gold mine have been analysed for their major and some trace elements (Fe, S, As, Ni, Co, Cu, Zn, Mn and Pb) by electron microprobe analysis (EMPA) at Humboldt University in Berlin and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) at the Julius Maximilians University in Würzburg. Every pyrite grain is different with regards to minor and trace element characteristics. Element mapping and spot analysis indicate an internal Co-As zoning with Ni enriched rims for many authigenic pyrites. As-Co correlations are interpreted to be the result of crystallization or of fluid assisted alteration involving dissolution-redistribution processes. The compact rounded grains are heterogeneous; primary zoning was not observed. Some of the compact rounded grains show a brecciated and locally recrystallized character, which may stem from the Vredefort impact event and subsequent hydrothermal activity. These compact rounded pyrites do not have Ni-Co enriched rims. Concretionary pyrite has a core of radiating bladed crystals surrounded by concentrically grown zones that often have elevated concentrations of lead. These 'oolitic' grains clearly did not form *in situ* because some grains are truncated and broken, almost certainly as the result of physical abrasion (England et al., 2002b). EMP analysis and mapping demonstrate that the outer zones are composed of a finely laminated pyrite with occillatory zonation of Co, Ni and As. There is a general decrease of As towards the core. The outer zones have the highest As-values determined in this study. PIXE data by Reimold et al. (2002) also indicate elevated As (and Ni) values in the outer zones of concretionary pyrites. EMPA and LA-ICP-MS analyses permit a rough chemical classification of pyrites for the VCR at Kloof Gold Mine, into the compact rounded, and euhedral authigenic pyrites with complex internal zonations. EMPA was especially successful in the identification of individual narrow growth zones that in part reflect *in situ* hydrothermal processes.

References

Hallbauer, D.K., 1986, The mineralogy and geochemistry of Witwatersrand pyrite, gold, uranium and carbonaceous matter, in Anheusser, C.R., and Maske, S., eds., Mineral Deposits of southern Africa: Johannesburg, Geol Soc South Africa Spec. Publ. 1, pp. 731-752.

England, G.L., 2002, Paleoenvironmental significance of rounded pyrite in silicilastic sequences of the Late Archaean Witwatersrand basin: Oxygen-deficient atmosphere or hydrothermal evolution: Sedimentology 49: 112-1156.

Feather, C., and Koen, G.M., 1975, The mineralogy of the Witwatersrand reefs: Mineral Science and Engineering 7: 189-224.

Frimmel, H.E. et al., 2005, The Formation and preservation of the Witwatersrand Goldfields, the World's largest gold province. Economic Geology 100^{th}Anniversary Vol: 769-797.

Reimold, W.U., Pryzbylowicz, W.J., and Gibson, R.L., 2002, Quantitative major and trace elemental mapping by PIXE of concretionary pyrite from the Witwatersrand Basin, South Africa: X-Ray Spectrometry 33: 189-203.

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