Mineralogy, geochemistry and origin of the Manganore iron formation, transvaal supergroup, R. S. A.

V. PAPADOPOULOS[1]*, H. TSIKOS[1], B. SMITH[2] AND C. HARRIS[3]

[1]Geology Department, Rhodes Univ., Grahamstown, S.A (*correspondance: ksaviar22128@hotmail.com)
[2]Department of Geology, Univ. of Johannesburg, S.A
[3]Department of Geological Sciences, Univ. of Cape Town

Banded Iron Formation (BIF) is protolith to most of the world's largest iron ore deposits. Although the dominant mechanisms of ore enrichment are not yet fully understood, several studies have considered hydrothermal activity as a key factor for iron upgrading [1]. The Manganore Iron Formation of the Transvaal Supergroup of S.A. is host to some of the largest and richest high-grade iron ore deposits, widely accepted to have formed through mainly ancient supergene processes [2]. New material from exploration drilling reveals profiles of ferruginous shale overlying ferruginized BIF, wherein irregular portions are found of rock reaching ore quality in terms of iron content (>60wt%). The footwall to the ore-bearing stratigraphy comprises the Manganore BIF, which consists predominantly of quartz and hematite, hence it is dominated by Fe_2O_3 and SiO_2 with all other common major element oxides barely exceeding 1wt%. The rocks variously exhibit pervasive silicification concentrated in horizons up to tens of meters in thickness, which may be related to silica leaching during the ore-forming process, and subsequent re-precipitation. Despite intense alteration, primary BIF textures such as quartz micro-lenses/pods apparently replacing earlier carbonate material, as well as pseudomorphs of hematite and quartz after magnetite and carbonates, are still recognizable. Secondary silica enrichment is also implied by coarser quartz aggregates and common collomorphic textures. Calcite, gypsum and chlorite are common vein-hosted minerals, while the first is also a matrix constituent of brecciated BIF. Crosscutting hematite veining suggests late-stage iron mobility, which proximal to the ore appears to enrich the rock through the development of hematite-rich micro-breccias.

We are currently focusing our work on vein-hosted silicate minerals, and on oxygen isotope analyses of various petrographic generations of quartz and hematite. Combination of our results and observations point to a complex, multi-stage event of ferruginization and silicification, probably as a result of brine fluid-flow that would have exploited the unconformable contact between shale and BIF as most suitable fluid conduit for the iron enrichment process.

[1] Taylor et al. (2001) *Econ. Geol*. **96**, 837-878. [2] Beukes et al. (2003) *Trans. Inst. Min. Metall*. **112**, B18-B25.