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3-dimensional distribution of ore minerals from the Au-U Witwatersrand Supergroup using spectral X-ray computed micro tomography

JONATHAN SITTNER[1,2], JOSE GODINHO[1], AXEL D. RENNO[1], VEERLE CNUDDE[2,3], MARGARITA MERKULOVA[4], BRADLEY MARTIN GUY[5], MARIJN BOONE[6], THOMAS DE SCHRYVER[6], DENIS VAN LOO[6], ANTTI ROINE[7] AND JUSSI LIIPO[7]

[1]Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz Institute Freiberg for Resource Technology
[2]Ghent University
[3]Utrecht University
[4]PProGRess-UGCT, Geology Department, Ghent University
[5]University of Johannesburg
[6]TESCAN XRE
[7]Metso Outotec

Presenting Author: J.sittner@hzdr.de

The Witwatersrand Supergroup in South Africa is not only the best-preserved sequence of Archean sedimentary rocks but also hosts the largest gold deposit on earth, yet discovered. The gold is situated in quartz-pebble conglomerates and is generally associated with a wide variety of minerals, including pyrite (FeS_2), uraninite (UO_2), pyrobitumen, base metal sulfides and phyllosilicates [1]. Despite extensive research over the past 100 years, the origin of the gold is still debated with two models receiving most of the attention: the modified paleoplacer model and the hydrothermal models [2]. The modified paleoplacer model assumes that detrital gold was transported into the host rock by fluvial processes, followed by a short-range mobilization (micrometer- to meter scale) by hydrothermal fluids that infiltrated the host rock [2]. In the hydrothermal model, gold was introduced into the host rock by postdepositional hydrothermal fluids from an external source [2].

To find new evidence for the origin of gold, we present new high-resolution 3-dimensional (3D) data based on the combination of X-ray computed micro tomography (micro-CT) and spectral X-ray computed micro tomography (Sp-CT). We combine both imaging techniques as micro-CT is an excellent tool for high resolution structural characterization and Sp-CT has the power to chemically identify a selection of minerals relevant in this study. Sp-CT is based on the analysis of X-ray absorption spectra, in particular specific K-edges, which assists in identification of chemical elements in a sample [3]. Since most of the previous research of the Witwatersrand gold focus on 2-dimensional methods, the outcomes of this study will help to understand the 3D spatial and size distribution of the gold and provide morphological information about individual particles.

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[1] Feather and Koen (1975), *Miner. Sci. Eng.* 7, 189-224.
[2] Frimmel et al. (2005), *Econ. Geol.,* 100th Anniversary Volume, 769-797.
[3] Sittner et al. (2020), *X-Ray Spectrom.* 50, 92-105.