Gold Mineralisation at Kansanshi Copper Mine, Zambia
PhD Research Proposal
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Overview
The Kansanshi copper mine currently produces in excess of 100,000 ounces of gold per year as a by product of its copper operation. Currently, gold is recovered from sulphide, mixed and oxide ore circuits by means of a gravity separator. The location, distribution and associations of gold in the sulphide (hypogene) environment, and subsequent redistribution(?) and associations in the oxide (supergene) environment are not well known. A greater understanding of the gold at Kansanshi is required to enable an upgrade from Resource to Reserve status, as well as aid future development and processing planning.

Introduction
The Kansanshi copper mine is located near Solwezi, in the Central African Copperbelt (CACB, Figure 1). Currently, it is the 8th largest producer of copper in the world. The deposit is hosted in metasedimentary rocks of the Katangan Supergroup, and occurs higher in the stratigraphy than most other deposits in the CACB. Primary copper occurs almost exclusively as chalcopyrite in quartz-dolomite-sulphide veins. First Quantum have owned Kansanshi since 2001, but did not start to extract gold at the mining operation until January 2009. Copper ore at Kansanshi is processed in one of a sulphide, mixed sulphide-oxide or oxide only circuit, gold is extracted from all three of these circuits via Falcon gravity separators. Gold appears to be predominantly concentrated in the oxide circuit.

Previous Work
Research on the occurrence of gold at Kansanshi is restricted to a single honours thesis in 2009 that focussed on mineralogical associations in drill core samples with known high-grade (up to 7g/t Au) gold intercepts. The study utilised standard optical petrology and microprobe analysis, and found that gold occurs as free gold in microfractured pyrite intergrown with chalcopyrite. An association of tellurides, nickel, and bismuth with gold was also highlighted. Beyond this study, there is no other dedicated research into gold at Kansanshi.
Figure 1. Location of the Kansanshi Copper Mine in the Lufilian Arc, Zambia.
Current Work
A current program of sampling the three ore circuits in the plant aims to characterise the gold carrying minerals in concentrate, their size distribution, exposure characteristics and mineral associations. This study is being conducted through SGS laboratories in South Africa.

Proposed Research Program
Aims and Objectives
- To better understand the processes and controls on primary gold mineralisation at the scale of the deposit.
- To better understand the location, distribution and associations of gold in the oxide environment.
- To identify any pit-scale criteria (alteration, structures, vein composition etc) or trends to help predict and identify gold mineralised zones. Ideally any criteria will be able to be used by resource and production geologists on a day to day basis.

Method
On site at Kansanshi, the candidate will be able to undertake an extensive program of pit mapping, core logging and sampling. Analytical work to be conducted off-site may include (but not restricted to):
- microprobe analysis or similar (QEM scan etc)
- LA-ICP MS
- low detection limit geochemical analyses
- isotopic analyses
- fluid inclusion analyses
- combine data in 3D software (Surpac or similar)

Outcomes/Deliverables
- Quarterly 1 to 2 page update on significant findings for the course of the study.
- Copy of all data generated.
- 3D model of relevant data sets.
- Summary document of any ‘on the ground’ tools/observations that can aid FQM geologists with respect to identifying gold mineralisation on day to day basis.
- Statistical analysis of gold distribution in the Cu deposit to aid in geological modelling thereof.

**Resources**
- The candidate will have full access to resource, grade control and exploration databases, as well as reports, maps, survey information and anything else that is required.
- FQM will provide a scholarship top-up, provided the candidate is successful in being granted a competitive scholarship in Australia.
- FQM will cover all relevant analytical costs as approved by FQM management.
- FQM will house and cater for the candidate on-site, and will arrange travel and necessary documentation.
- Any vaccinations required for the candidate will be covered by FQM.

**Other**
Murray Hitzman from the Colorado School of Mines has extensive experience with the Kansanshi deposit, and has expressed an interest to be involved in the gold project. Murray’s involvement would be advisory, unless it is deemed necessary for his input to be more significant.