PhD research collaboration with Barrick Gold Corp

Controls on the distribution and chemistry of pyrophyllite-quartz alteration in high sulphidation epithermal ore deposits: developing vectoring and fertility tools for project assessment

The objective of the research project will be to develop textural and mineral chemical tools for exploring within pyrophyllite-quartz alteration domains in high-sulfidation (HS) epithermal systems and build an underlying understanding of the controls on pyrophyllite structure, chemistry and distribution in HS deposits. In addition to conventional characterization approaches, the project will aim to: (1) develop pyrophyllite trace element chemistry as a vector and fertility tool (known substitutions include Fe, Ti and Ga); (2) explore the use of low-cost, hot-cathode cathodoluminescence to characterize quartz and pyrophyllite response from fertile vs. barren systems and as a function of spatial position within a mineralized system; (3) evaluate UV-fluorescence spectroscopy as a quantitative and low-cost tool for fingerprinting pyrophyllite associated with fertile ore systems; (4) testing Raman spectroscopy alongside SWIR and LWIR spectroscopy for better discrimination of pyrophyllite and assessment of OH-stretching variations.

METHODOLOGY

Mapping of pyrophyllite distribution in selected, world-class HS systems using field mapping, portable SWIR/XRD and satellite spectral data; petrography/textural analysis; whole rock geochemistry/chemical mass transfer of alteration in different protoliths; high resolution SEM (FEI Quanta); Microprobe (new field emission Jeol JXA-8530F with 100 nm resolution and low detection limits); LA-ICP-MS trace element chemistry; Lumic hot-cathode cathodoluminescence (panchromatic CL of quartz); and UV-fluorescence spectroscopy (Cary-Eclipse from Agilent).

Sampling would need to be done at a variety of sites worldwide covering a spectrum of deposit sizes and “barren” systems with at least one detailed case study of a well-endowed system where 3D sampling of the system is possible. Analysis could include “background” specimens from the NHM mineralogy and ores collections.

Zunyite in pyrophyllite and euhedral quartz, Big Bertha Extension, Dome Rock Mountains, La Paz County, Az (high sulfidation gold prospect). Hand specimen and sample under UV light showing fluorescence. John Betts Fine Minerals.
KNOWLEDGE TRANSFER
Knowledge transfer to the project partner will occur by: (i) progress meetings/reports; (ii) presentations at the Company’s head office or another location as agreed between the Parties; (iii) presentations on site (where applicable). Knowledge transfer to scientists and wider industry will be achieved by: (i) presentations at international/national conferences; (ii) publishing papers in leading journals, e.g. Geology, Chemical Geology.

We will encourage the PhD student to become an Imperial College London (ICL) Outreach Ambassador to go into schools to talk about research and careers in the minerals industry. The PhD student will also engage with undergraduate students in classes and seminars at ICL, and the general public at the Natural History Museum, London (NHM), via events such as “Science Uncovered” resulting in an active transfer of knowledge to the next generation of scientists, industry practitioners, consultants and public servants.

SUPERVISION DETAILS
The main academic supervisor, Dr Jamie Wilkinson, has a permanent appointment as Research Leader in Mineral Deposits at NHM, and retains a post at Imperial College London (ICL) where it is intended that the student will be registered for their degree. The project will be co-supervised by Dr Andrew Wurst, Barrick Gold Corporation. Fieldwork will be supervised by academic and Barrick staff as appropriate. Training in the field skills necessary for the project will be delivered by (i) attendance on a NERC exploration methods course or appropriate SEG field course prior to the first field season (if available); (ii) workshop on porphyry collection material at NHM; (iii) field supervision on site. Laboratory studies will be carried out at NHM within the LODE research group which is a collaboration between the Department of Earth Science and Engineering (ESE) at ICL and the NHM and includes the LODE laser ablation ICP-MS laboratory as well as numerous other world class analytical laboratories. For more information about the London Centre for Ore Deposits and Exploration, see: http://www.imperial.ac.uk/earth-science/research/research-groups/lode/

FUNDING
The project is fully-funded by Barrick Gold Corp. The successful student will receive a stipend of £17,553 per annum which is in line with current NERC awards with London weighting and includes a top-up element related to the company support and attendant additional reporting requirements. **Only students eligible for Home fee status can be considered.**

HOW TO APPLY
Interested candidates should contact the supervisor j.wilkinson@nhm.ac.uk in the first instance with a CV and statement of interest. Candidates will then need to complete the Imperial College online application via: https://www.imperial.ac.uk/study/pg/apply/how-to-apply/apply-for-a-research-programme/

The deadline for applications is Monday 18th February 2019, with interviews expected on Wednesday 6th March (to be confirmed).