

PhD research project

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

We seek a talented and highly motivated PhD candidate for a project fully-funded by Barrick Gold Corp. The objective is to develop textural and mineral chemical tools for exploring within pyrophyllite-quartz alteration domains in high-sulfidation epithermal systems and build an underlying understanding of the controls on pyrophyllite structure, chemistry and distribution.

**Background**

Ore deposits are exceedingly scarce. Only one in every one thousand prospects that are explored by companies is developed into a mine, and finding these prospects has already consumed significant time and resources. Consequently, understanding what controls the location of ore deposits, recognizing the potential fertility of an area before costly and invasive exploration has taken place, and exploring efficiently within such domains are important for reducing risk, energy use and environmental impact.

Epithermal ore deposits source much of the gold, silver and significant amounts of the copper utilized by humankind. They form at relatively shallow crustal levels, often directly or indirectly associated with magmatism at subduction zones. Ore-forming processes are relatively well understood, as are the typical alteration mineral assemblages that develop and their zonation patterns. However, little work has been done on the minor and trace element chemistry of alteration phases, which has been to be shown to be a powerful tool for exploration in porphyry ore systems. The use of such approaches is becoming increasingly important because most new resources will be buried under cover; either pre-mineralization rocks that may be altered into barren lithocaps, or post-mineralization cover. Thus, utilising all possible information from shallow alteration domains and maximising knowledge from limited drillcore samples is critical.

**Approach**

Work will include petrography/textural analysis, SWIR spectroscopy, X-Ray diffraction, high resolution SEM, Microprobe and LA-ICP-MS trace element chemistry, hot-cathode cathodoluminescence and UV-fluorescence spectroscopy. Sampling would 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 is also likely to include “background” specimens from the NHM mineralogy and ores collections. The aim is to map and understand the distribution and compositional characteristics of pyrophyllite, define gradients that can be used for targeting purposes and develop multivariate geochemical tools to discriminate barren from mineralized centres.

**Join a world-class research team!**

The main academic supervisor, Dr Jamie Wilkinson, has a permanent appointment as Research Leader in Mineral Deposits at the Natural History Museum (NHM), London, where the student will be based, and is Director of the London Centre for Ore Deposits and Exploration (LODE). He 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, Chief
Geologist, Project Generation, Innovation and Research – Global Exploration at Barrick Gold Corporation. Dr Wurst is an innovative explorationist with broad experience in mineral assessment, exploration, mining and research and a track record of successful evaluations, acquisitions and discoveries. 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 facilities. 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 includes a top-up element related to the company support and attendant additional reporting requirements. Only students eligible for UK/EU Home fee status can be considered unless an alternative source of funds can be secured for the Home-Overseas fee difference, currently £19,240 per annum.

**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/

There is no fixed deadline for applications; we will organise interviews once we have identified a suitable slate of candidates. The PhD project can be started as soon as the selected candidate is available.

*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.*