Hydrothermal PGE and Au transport from upper crustal felsic magma

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At the Northparkes porphyry copper gold deposits, New South Wales (Australia), subspherical, fist-sized bornite ± chalcopyrite clots (Fig. 1) occur within mineralised felsic intrusions. Their shape and volume suggest that they crystallised from immiscible sulfide melts exsolved from silicate magma. To investigate this hypothesis, we obtained concentrations of platinum group elements (PGE), Au, S, FeO, Ni and Cu on clot samples and compared these with typical vein-type porphyry Cu sulfide ore.

Total whole-rock PGE concentration of clot-bearing samples is around 1 ppm, 40 times more than for vein samples (typically around ~ 25 ppb). Gold occurs as heterogeneously distributed native Au grains, with concentrations in clot samples of 4 to 31 ppm, and 0.8 to 12 ppm in vein samples. PGE concentrations increase exponentially with increasing sulfide proportion, and Au/PGE ratios of clot samples are lower than vein samples. Gold in bornite clots preferentially occurs in or near cross-cutting quartz veins and their alteration haloes, suggesting that Au-mineralisation was later than bornite-clot±PGE formation. Minimum Pd/Ir ratios of the clots are in the order of 10^2 - 10^5, similar to those of other porphyry copper deposits and different from those of orthomagmatic sulfide deposits (10^0 - 10^2). This implies that either post-intrusion hydrothermal activity affected the chemistry of the clots or that they were hydrothermal in origin.

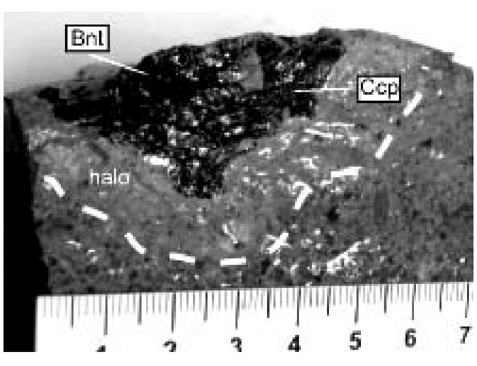

Figure 1: Bornite (bnt) ± chalcopyrite (ccp) clot with alteration halo (dashed) in altered monzonite porphyry from Northparkes, NSW, Australia.

How As mitigation in Bangladesh can be hampered by other factors, some geogenic (Mn, P), others not

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Exposure to As contained in groundwater has dropped significantly in Bangladesh as a result of (1) blanket testing of millions of tubewells with a field-kit, (2) the installation of tens of thousands of deeper wells extending to low-As aquifers and, to a lesser extent, (3) the deployment of thousands of As-removal systems.

However, the continuing installation of private tubewells that typically remain untested, high levels of Mn in some deeper aquifers that are low in As, early failure of As-removal systems in some regions of Bangladesh where P levels in groundwater are particularly elevated, and insufficient monitoring against the occasional failure of deep wells or arsenic removal systems all mean that the battle is far from won. There is also some concern based on hydrogeological considerations that shallow aquifers that are low in As might be particularly vulnerable to contamination with microbial pathogens. Each of these issues will be addressed on the basis of field data gathered in Bangladesh over the past 8 years. The value for targeting low-As aquifers of an existing compilation of 5 million field-kit tests paired with location and well-depth will also be illustrated, along with a plan for Grameenphone and the Department of Public Health Engineering to disseminate this information.

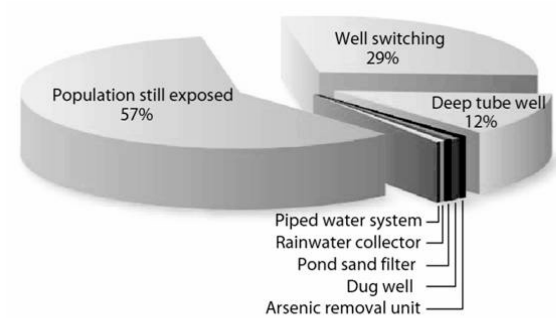

Figure 1: Impact of arsenic mitigation in Bangladesh [1]

[1] Ahmed, M.F., *et al*. (2006) *Science* **314**, 1687-1688.