

## **Structural Evolution, Vein Orientation and Paragenesis of the Botija Porphyry Cu-Mo-Au Deposit, Colón, Panamá**

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The Botija Cu-Mo-Au porphyry deposit is located in the Cobre Panamá mining district which contains several deposits with a global M+I resource of 14.8 MT of Cu. These deposits are associated with the Cerro Petaquilla batholith, which has U/Pb zircon ages of 26-33 Ma. The Botija deposit is an elongate tabular orebody striking northeast and dipping 20-40°N and measures 2 km x 1 km x 500 m in size. The deposit is hosted within a crowded porphyritic granodiorite with 30 vol.% groundmass of quartz and K-feldspar. Phenocrysts include plagioclase, hornblende ± K-feldspar and occasionally 1-2 vol.% rounded quartz eyes. Ore is characterized by Cu-Fe sulfides (chalcopyrite > bornite) that is dominantly disseminated but also present in magmatic-hydrothermal quartz veins. Systematic vein measurements at Botija demonstrate that copper ores are spatially associated with a quartz vein density >0.5 vol.%; these veins generally strike 230/50°NW and 295/50°NE. Most early quartz veins are emplaced as near-vertical hydrofractures in numerous porphyry deposits globally. The present dip of these quartz veins suggest that the veins and the Botija deposit have been moderately tilted about 40° N after mineralization. Typical potassic and sericitic alteration and zonation is present in Botija, however, a late overprint of chlorite and zeolite has obscured the original magmatic hydrothermal alteration footprint. Although the Botija deposit exhibits many of the common porphyry copper features, its geometry is atypical with abrupt spatial transitions (<10 m) in alteration and grades (Cu & Mo) whereas most porphyry copper deposits typically exhibit gradual transitions in 100s m. These sharp breaks in the geology together with mapped faults in field exposures and drill core allow identification of three main fault sets that offset the deposit. A restoration of the Cu and Mo grade shells indicates a multistage post-mineral deformation history with a first stage of ~300 m left lateral offset on the Botija Fault (267/50°N) and a second stage of normal movement with 300 m offset on S50°W-striking faults (230/65°N). Restoration of these fault offsets brings the ore shells to the appropriate inverted cup shaped geometry. An additional restoration of the 50°N-dipping quartz veins to vertical restores the ore shells to geometry in line with the classical shape for a porphyry copper deposit. The identified faults and kinematics at Botija are consistent with previously studied SW striking left lateral Rio Gatún fault system 120km east in the Panamá Canal Zone.