

## Trace elements in pyrite from porphyry Cu mineralizations in young island arcs, Koloula Igneous Complex, Guadalcanal, Solomon Islands

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Porphyry ore deposits are important resources for Cu, Mo, Sn, W, Re and Au that are typically associated with shallow magmatic intrusions in thick arc crust (>45 km) [1]. However, porphyry mineralizations in the Western Pacific region also occur in young island arcs that are characterized by a crustal thickness <25 km. Little is known about the magmatic-hydrothermal processes that lead to porphyry mineralizations in these atypical environments and their economic potential has also been poorly constrained to date. Here, we present data on the in-situ trace element composition of porphyry pyrite from different alteration zones related to the Koloula Igneous Complex, Guadalcanal, Solomon Islands [2]. We present a new chemical-statistical method, which allows to filter trace element data of pyrite for compositions that are affected by micro- to nano-scale inclusions, which may not be diagnostic for the precipitation conditions of pyrite [3, 4]. Importantly, trace element variations in pyrite between different alteration zones are better defined by the filtered data than by the original analyses, indicating that inclusions in pyrite obscure its chemical signature with respect to the mineralization process. In combination with the alteration mineralogy and fluid inclusion data of quartz and calcite from related samples [5], we present a hydrothermal model for the formation of porphyry mineralizations in thin island arc crust (<25 km). We suggest that the observed trace element variations in pyrite (e.g., Se, Ge, Pb, Ag) are the result of fluid temperature variations ranging from ~650°C in the potassic alteration zone to ~300°C in a potential epithermal transition zone. Alongside the temperature variations, we propose that changes in fluid pH and salinity are caused by a combination of boiling and variable degrees of mixing with meteoric and/or ocean water, which leads to systematic variations in the Co/Ni and Ge/Se ratio in pyrite.

[1] Tang et al. (2020), *Science Advances* 6, 1-5. [2] Chivas (1978), *Economic Geology* 73, 645-677. [3] Keith et al. (2018), *Ore Geology Reviews* 96, 269-282. [4] Keith et al. (2020), *Geochimica et Cosmochimica Acta* 274, 172-191. [5] Chivas & Wilkins (1977), *Economic Geology* 72, 153-169.