# From regional- to local-scale exploration for porphyry systems in the Northern Bowen Basin (NE Australia): Mineral, whole rock and zircon geochemistry

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The Northern Bowen Basin (NE Australia) has large exposures of Carboniferous-Permian volcanic rocks hosting many magmatic-hydrothermal deposits (e.g., porphyry copper, high and low sulfidation epithermal deposits; [1, 2, 3]. The land extension where porphyry systems can be potentially found is an area of ~4,000 $Km^2$. In order to narrow donw the exploration area we have applied the current magma fertility knowledge (whole rock and zircon geochemistry) on the volcanic rocks fo this region.

Fertility studies established fertile and barren criteria using whole rock geochemistry parameters (e.g., Sr/Y vs. $SiO_2$, V/Sc vs SiO2 and Pd/MgO vs. Y; [4, 5]). Additional contributions to magma fertility have been proposed by Lu et al., [6] using zircon trace element geochemistry (e.g., Eu/Eu* vs (Ce/Nd)/Y and 10000*(Eu/Ey*)/Y vs. (Ce/Nd)/Y). Such parameters (whole rock and zircon geochemistry) are indicative of the water content and the oxidation state of the magma, and thereby predict the potetntial metal types and endowment, if there are mineral deposits produced by these magmas.

At local scale, where evidences of hydrothermal alteration are found (e.g., advanced argillic alteration/lithocap), alunite mineral chemistry and SWIR are used as exploration vector. According to Chang et al., [7], who intensively studied the Lepanto deposit, alunites are Na- and Ca-rich in the proximity of the causative intrusion (porphyry copper deposit) compared to the distal alunites which are K-rich.

Combination of both regional and local-scale geochemical exploration are fundamental to narrow down the exploration area as well as to locate better targets, increasing the probability of success.

[1] Corral et al., (2017) *Society of Economic Geology SEG 2017 Conference.* [2] Sahlström et al., (2017) Minerals v. **7(11)**, 213. [3] Sahlström et al., (2018) *Economic Geology* v. **113**, 1733-1767. [4] Loucks (2014) *Australian Journal of Earth Sciences* v. **61**, 5-16. [5] Hao et al., (2019) *Journal fo Petrology* v.**1**, 1-27. [6] Lu et al., (2016) *Society of Economic Geology Special Publication* **19**, 329-347. [7] Chang et al., (2011) *Economic Geology* v. **106**, 1365-1398.