Porphyry Exploration at First Quantum Minerals – Active Application of New Techniques

S. Sykora[1], *T. Ireland*[2]

1.
Exploration Geologist – Global Generative and Research, First Quantum Minerals Ltd., West Perth WA 6005. stephanie.sykora@fqml.com

2.
Principal Exploration Geologist – Global Generative and Research First Quantum Minerals Ltd., West Perth WA 6005. tim.ireland@fqml.com

ABSTRACT

First Quantum Minerals Ltd. (FQM) is a company that historically owns and explores for sedimentary-hosted copper deposits. However, since 2012 FQM has built a team dedicated to exploration for porphyry copper deposits, and acquired several major porphyry assets, notably in Panama, Argentina and Peru. As relative "newcomers" to the porphyry exploration game, FQM has the opportunity to approach porphyry exploration with a fresh perspective that combines new techniques and technology with well-established geological practises, and we have mostly empowered a group of young geoscientists to execute this strategy.

Porphyry copper exploration at FQM is considered across all scales, from global terrane selection to prospect evaluation. At the local scale, FQM routinely conducts conventional anaconda-style mapping and collects high quality, broad-spaced systematic near-complete digestion multielement surface geochemistry and spectral mineralogy as baseline datasets. Where required, and especially in areas of sparse outcrop or widespread shallow cover, we subsample continuous datasets (mag, radiometrics, hyperspectral) to the chemistry/mineralogy to generate a single dataset containing channels from multiple sources. Machine learning methods are then applied to this 'quantitative merger' and trained against sites of well constrained geological, physical, and chemical properties. Random Forests, one such supervised classification approach, can allow such non-linear data fusion and yield products such as predicted lithology maps under cover, and an objective "audit" of a geological interpretation maps. At the same time as developing new techniques, we strive to honour our geologists' fundamental field and mapping observations, and to iterate between conventional and modern methods to arrive at a reliable 3D interpretations of a porphyry environment as quickly, and cost effectively as possible. One major impediment to this workflow is digital data capture and integration, and field mapping software has substantial room for improvement to allow smarter and rapid data capture and thus 'enhanced' understanding of the surroundings while exploring an area actively.