

XRF Spectral Classification of Mineralization Style in Porphyry Copper Systems

Oliver Newland¹

¹Veracio, Salt Lake City, United States

X-ray fluorescence (XRF) datasets are increasingly used to support geological interpretation and predictive modeling and can provide geochemical information more rapidly than laboratory-based geochemical analysis. However, calibration model performance depends on how well the calibration dataset represents the mineralization style being analyzed. This study examines whether XRF spectra can be classified by mineralization style prior to calibration, providing a basis for selecting the most appropriate calibration model and, where necessary, defining more tightly constrained calibration populations. The aim is to enable more precise targeting of samples to calibration models that are better matched to the geological context.

Porphyry copper systems provide the initial test case. These deposits span broad variation in lithology, alteration assemblage, sulfide mineralogy, and mineralization intensity, making them a useful setting in which to test whether mineralization-related spectral populations can be distinguished. Rather than relying only on processed elemental outputs, the study considers full XRF spectra to assess whether they preserve sufficient information to separate porphyry-related sample groups prior to calibration.

Resulting spectral groupings will be assessed against available geological information to determine whether they correspond to meaningful mineralization domains. The objective is to establish whether spectra assigned to a porphyry-related population can be directed to porphyry-specific calibration models, and whether this classification can also support selection of more representative calibration samples within those domains. This would provide a basis for more tightly constrained calibrations and improve the accuracy and consistency of XRF-derived geochemical predictions in porphyry copper systems.