

An Unsupervised Approach to Spectral Classification

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Scanning diverse core samples with X-ray fluorescence (XRF) technology provides geochemical information that is critical for understanding deposit variability. However, accurately identifying lithologies from XRF data remains a tedious and labor-intensive task. Traditional approaches often classify spectra based on spatial proximity along the core or rely on manual, supervised interpretation. Spatial proximity classification can result in multiple lithological types classified together. Supervised interpretation can lead to classification errors as lithological classification can differ between geoscientists.

This study presents a novel, unsupervised spectral classification workflow to improve lithological identification. Using Veracio's XRF technology, precise intensity measurements are acquired at discrete intervals along the core. This method leverages intrinsic spectral similarity rather than relying on the physical location. Elements that vary the most between different lithologies are first identified and used as key discriminators among spectral types. Intensities of these variation elements are then compared using cosine similarity, enabling robust grouping of spectra with highly similar geochemical signatures. A similarity of 98.5% was found to be a strong indicator that spectra belong to the same lithological population.

This unsupervised method will enhance orebody knowledge and deposit characterization by grouping spectra based on geochemical similarity. This method preserves geochemical anomalies while avoiding the pitfalls of visual lithological identification. This allows the geoscientist to first review the natural geochemical clustering of their deposit before assigning a lithology. The resulting classifications provide a more accurate representation of our lithologies and mineral patterns in the core.