

XRF Rock Characterization Techniques for Research and Mineral Exploration

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The physically heterogeneous nature of rock presents several challenges to non-destructive X-ray fluorescence (XRF) analytical applications. However, efficient and accurate rock characterization is becoming increasingly attainable by the optimization of XRF technologies and data processing methods. Here, we present two studies that investigate how XRF core scanning technologies can be used to better characterize the chemical variability of hard rock cores. Using a standard, energy-dispersive core scanning XRF, we first outline a method for filtering and calibrating large XRF chemical datasets, using Scientific Ocean Drilling basaltic cores as a case study. By comparing our processed XRF core scanning dataset to portable XRF and ICP-MS datasets, we show that the core scanning dataset, despite its limitations, can reveal small-scale chemical variations often hidden in datasets collected manually, which usually represent lower spatial resolutions and contain sample bias [1]. Second, funded by an NSF INTERN opportunity for graduate students, I assisted Veracio's research and development of an XRF instrument which leverages greater energy ranges to measure heavier elements, such as gold and rare earth elements. I conducted a repeatability study using an OREAS certified reference material to repeatedly measure Au K α -peak counts to study the effect of sample placement and continuity of the X-ray beam. Results revealed that while the placement of a sample had no effect on the resulting counts, pausing the beam between analyses affects the internal temperature of the X-ray detector and results in variable counts. These two case studies exemplify the potential of XRF core scanning to characterize hard rock as a powerful non-destructive method with applications in both academic research and mining exploration.

[1] Morris et al. (2026). Recommendations for using core XRF data on basaltic rock as a tool to assess compositional variability. Scientific Drilling, doi:10.5194/sd-35-21-2026