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# Performance of portable XRF and micro-XRF on carbonates

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Variations in elemental abundances in various carbonate archives offer a wealth of paleoenvironmental proxy information. State of the art portable handheld X-Ray Fluorescence (pXRF) and laboratory micro X-Ray Fluorescence ($\mu$XRF) instruments provide a relatively inexpensive and fast way of acquiring elemental composition data. However, there are well-known issues and limitations regarding the conversion of XRF spectral data into elemental concentrations. This study aims to offer a guideline for the appropriate use of these XRF techniques for the study of carbonates. Using a certified calcium carbonate standard, accuracy and reproducibility of both a pXRF (Bruker AXS Tracer IV) and a $\mu$XRF (Bruker M4 Tornado) instrument are tested under various measurement conditions.

The experimental set-up allowed for the variation of several parameters, including measurement area, integration time, quantification method and filter use. The effects on the accuracy and reproducibility of the quantified elemental abundance results are examined in order to investigate under which conditions both devices perform best in determining trace element abundances in natural carbonates. The limits of detection and quantification are evaluated for both instruments for a range of commonly used trace elements (e.g. Sr, Mg, Zn, Fe ...). The quality of the XRF spectra is evaluated using spectral processing software. Additionally, different methods of quantification are discussed. As a result, optimized parameter combinations are proposed for a range of commonly used elements. Finally, a comparison between the two X-Ray Fluorescence instruments allows the evaluation of their respective advantages and disadvantages and helps to determine which technique is best suited for a specific research question.