# Evaluation, transformation, and recognition: a comprehensive 3-steps guideline for the data processing of XRF-core scanning technique

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The fast, non-destructive and ultra-high resolution X-ray fluorescence core scanning (XRF-CS) technique has been introduced to assess down-core elemental variations as indicators for past environmental and process changes down to annual and even sub-annual timescales. Although it has revolutionized elemental proxy-based paleo-researches over the last decade, three long-standing challenges, including (1) reliable quality assurance and quality control (QA/QC); (2) calibration of the organic closed-sum effect; (3) dealing with big datasets as proxy-based interpretations, are identified in this proposal and thus need to be addressed towards harvesting the full potential of the XRF-CS technique. By outlining the current methodological challenges, a practical guideline and working flow, including (1) reliable QA/QC by depth-dependence local similarity evaluation, (2) calibrating the matrix closed-sum problem by centered-log ratio transformation, and (3) usages of robust multivariate statistical methods, will be provided to harvest the full potential of the XRF-CS technique. Particular focus will be devoted to (1) annually-varved lake Millstättersee (Austria), which has 700 years historical records documenting floods, earthquakes, and human occupation and (2) sediment cores retrieved from the Japan Trench, which contain records of giant megathrust earthquakes since AD 869, in order to demonstrate the usefulness of our data processing approach.

 