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Comparing XRF core scan data to conventional geochemical analyses for high resolution paleoenvironmental studies

Rick Hennekam and Gert J. De Lange
Utrecht University, Geosciences, Utrecht, Netherlands (gdelange@geo.uu.nl)

X-ray fluorescence (XRF) core scanning is becoming an increasingly common method to rapidly obtain paleo-environmental data from untreated (marine) sediments. There is a large potential for this method, being cheap, rapid, and non-destructive. However, the sediment surface is not an ideal substrate for XRF-analysis, thus measurement artefacts may occur relating to water content, grain size, surface roughness, film formation, and sediment inhomogeneity. A high resolution analysis of an Eastern Mediterranean sediment core is used to compare such potential artefacts and signal-to-noise ratio of XRF core scan measurements to those of traditional analyses using XRF glass bead and ICP-AES on distinct samples. A suit of major elements (and elemental ratios), often used as paleo-proxies, have been examined in this way so as to compare the robustness of the more 'relative' XRF-scan method compared to these more 'absolute' measurements.
XRF core scan data only reflect the chemical composition of a thin (5-500 μm) layer of the sediment surface. Any inhomogeneity in this surface can cause large deviations thus may result in large 'deduced' paleo-environmental variability. It is shown that (random) water-rich spots can form underneath the Ultralene covering foil, having a substantial effect on the lighter elements with shallow response depths. This can create non-existing peaks in the XRF core scan -produced paleo-environmental record. Such deviations especially occur for elemental ratios when various elements are measured in different runs (e.g. other tube-voltage settings). This study urges to verify high/low amplitudinal variability observed in XRF corescans by means of (destructive) conventional geochemical analyses prior to their interpretation..

Reference:
Hennekam R. and G. de Lange. X-ray fluorescence core scanning of wet marine sediments: methods to improve quality and reproducibility of high-resolution paleoenvironmental records. Limnology and Oceanography: Methods 10, 991-1003, 2012. DOI 10.4319/lom.2012.10.991