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A detailed comparison of high-resolution paleoclimatic records produced by XRF core scanning to conventional measurements: examples from the Nile and Gallipoli area

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The X-ray fluorescence (XRF) core scan technique is due to its high-sampling resolution, speed, and cost, an attractive tool for paleoceanographic and sedimentological studies. Nevertheless, analytical deviations may occur in such scan data caused by the physical properties of a (wet) sediment surface (i.e. grain size, water film formation under the covering plastic etc.). To elaborate on potential XRF-scan measurement artefacts, we will compare our results from XRF core scan to those from XRF-bead and/or ICP-OES done on parallel samples for several marine cores from the Nile delta and Gallipoli area. We focus on elements, and ratios, often used in high-resolution paleoenvironmental studies of marginal basins.
We show that large deviations in XRF core scan results can occur, especially in very water-rich core sections with high interstitial water contents. Subtle variability in water film thickness can cause substantial variability in elemental counts of elements with shallower response depths. These artifacts occur on cm-scales, leading to apparent variability of all elements from Al to Fe on these same scales. To avoid erroneous paleoenvironmental interpretations we show ways of recognizing these effects, as well as possibilities for further amending for these effects. The removal of such erroneous analytical results is essential for the adequate interpretation of in particular high-resolution paleoclimate studies.