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Late Weichselian sediment geochemistry of the western Barents Sea margin - an empirical inter-instrumental comparison of core scanning and conventional XRF measurements

Martin Klug (1), Jochen Knies (1), Matthias Forwick (2), and Haflidi Haflidason (3)

(1) The Geological Survey of Norway, N-7491 Trondheim, Norway, (2) University of Tromsø, Department of Geology, N-9037 Tromsø, Norway, (3) University of Bergen, Department of Earth Science, N-5007 Bergen, Norway

During the last years an increasing number of studies in geosciences made use of the fast and non-destructive XRF scanning method. To create robust and reproducible data and to interpret geochemical variations across records of different origin and from different instrumentations inter-instrumental comparison becomes a necessary, inevitable and decisive procedure. In this study we present results from an empirical approach of an inter-instrumental XRF comparison including the Avaatech (University of Tromsø), Itrax (University of Bergen) and InnovX-GeoTek (The Geological Survey of Norway) core scanners. In addition single samples were measured with the PANalytical AXIOS XRF spectrometer and the Perkin Elmer 4300 Dual View ICP-AES measurements (both at the Geological Survey of Norway).

We analysed the split-surface of a 300 cm long marine sediment core from the continental slope of the western Barents Sea (71°30'N, 16°10' E). The sediment core sections were logged near-continuously with the core scanners along the centre of the core axis, followed by measurements of discrete samples. All devices were standardized and calibrated prior measurements according to the individual, requisite standardisation routines. Results presented here were harmonized to common sampling midpoints. We tested element ratios commonly used in geosciences.

Most of the down-core variations of element ratios from the core scans occur in general synchronously and match the variability of single sample measurements from the stand-alone XRF-analyzer indicating a convenient XRF technique implementation in the scanning instruments. However, in certain cases, element ratios appear to show very low variations, likely an indication of detection-limit problems or larger uncertainties associated with the determination of low element concentrations. Apart from good relative fit, absolute variations occur at different levels and instrumental deviation varies for particular element ratios. This likely indicates variations of instrumental sensitivity for individual elements, e.g. the X-ray tubes used and/or can be the result of different internal mathematical models used for the conversion of raw data. To overcome inherent scanner-result variations due to different instrumental sensitivity and conversion models, and to minimize under or overestimation of elemental concentrations, we recommend not only to rely on individual calibration and standardization routines but also to introduce inter laboratory testing, especially when comparing absolute variations of XRF core scanning results acquired with different instruments.