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A comparison of geochemical core scanning methods on high-grade metamorphic COSC-1 cores

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Micro-XRF core scanning of marine and lacustrine sediment cores provides geochemical data for many elements and has become a standard tool in paleoclimate and environmental studies. In contrast, such investigations are unusual on crystalline cores due to limitations such as crystal lattice reflections.

We tested micro-XRF scanning on gneisses and mylonites of the COSC-1 ICDP project in the Swedish Caledonides. The data obtained was compared with new high-resolution half-split core surface mapping using an ED-XRF instrument (50 μm res.) and Laser Induced Breakdown Spectroscopy (LIBS) core scanner (200 μm res.). In addition, an assessment was made with whole-core box oversight XRF scanning (Minalyze AB) with 10 cm resolution.

High-grade metamorphic rocks including metasedimentary leucocratic gneisses and intercalated mica-rich mylonites of the lower Seve Nappe drilled during COSC-1 have been investigated to compare scanning methods. All data sets show a clear compositional step between gneiss and mylonite indicating a metasedimentary mixed layer origin (sandy to clayey) of the source rocks with extremely limited metasomatic exchange. Micro-XRF profiles are in full accord with high-resolution mapping data but cannot reproduce the detailed structural information provided by mapping data. LIBS data include light elements such as Li that are not measurable with XRF methods and confirm a sharp non-metasomatic transition between gneisses and mylonite. The whole-core box XRF scans are extremely useful to scan the 2500 m of cored material in a short time compared with other methods, and the data is very helpful, for example, for geochemical reconstructing of lithologies.