



Redox and speciation micro-mapping of iron using dispersive XANES spectroscopy: Application to a metamorphic rock thin section.

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Mapping offers fundamental knowledge for heterogeneous samples as it integrates punctual information in a continuous two-dimensional space. Generally, mapping processes are based on chemical analyses whereas other information such as redox or speciation is only accessible locally. In this study, we present the first dispersive μ -XANES mapping providing in situ characterization of the oxidation state and speciation of iron. The experiments have been carried out at the Fe K-edge, on the “Dispersive-EXAFS” beam line ID24 of the European Synchrotron Radiation Facility (ESRF; France). The mapping has been performed on a metamorphic rock polished in a thin section of 30 μm including different types of minerals. Because of the high X-ray absorption due to the thickness of the glass sample holder (1 mm), the data have been collected in the fluorescence mode using the so-called “Turbo-XAFS” design. The effective spot size was about 10 by 10 microns and the mapping was 390 by 180 microns. Each XANES spectrum was recorded within 1.5 seconds and by steps of 5 microns so that 2808 spectra were collected including full XANES information. Automatic procedures for data reduction and mapping reconstruction were developed. The results consist of visualizing cartographies of iron content, oxidation state and speciation, with a 5 μm spatial resolution after 2D deconvolution. Subsequent analyses of the reconstructed images provide some quantitative calibrations.