Differentiation and quantification of sulfur species by X-Ray Fluorescence (WDX)

Stephanie Uhlig[1], Alexander Plessow[1], Robert Möckel[2*]

[1]TU Bergakademie Freiberg, Institute for Mineralogy, Brennhausgasse 14, 09599 Freiberg/GERMANY

[2]Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz-Institute Freiberg for Resource Technology, Chemnitzer Str. 40, 09599 Freiberg/GERMANY

*Presenting Author

Several analytical methods are known and well-tried to differentiate sulfur species in aqueous solutions, e.g. ion chromatography (Miura et al. 2005) or photometry and titration (Blasius & Ziegler, 1973). Most geochemical samples are a challenging because they are solids and cannot be analyzed directly. Conventional digestion techniques require the application of water and acids which causes an oxidation of the sample and avoids a reasonable specification of single sulfur species after the digestion.

Wavelength-dispersive X-Ray fluorescence analysis (WD-XRF) enables an examination of solid samples without chemical pre-treatment. The initial point was a project dealing with tailings from Sn processing containing partially oxidized sulfidic ores. An earlier publication had already shown a technique for successful quantitative differentiation of sulfides and sulfates by WD-XRF (Uhlig et al. 2016). This technique based on the shift of S Kα and S Kβ lines in the fluorescence spectra, was extended on other inorganic sulfur species. Na_2S, $Na_2S_2O_3$, Na_2SO_3, Na_2SO_4 and elemental sulfur S cover the whole range of oxidation states of sulfur from -II to +VI and are the base for these examinations.

An extensive literature research showed that the S Kα line of thiosulfate in fluorescence spectra was not described before. Our work closes this gap (Uhlig & Pleßow, in prep.). Furthermore, the challenging, but yet possible quantification of mixtures of two species each should be mentioned. Currently, we are working on the transferability of our examinations of samples with defined species to sulfur species in real soil samples, where a bigger variety is expected.

References:

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