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Advantage and disadvantage of μ-EDXRF (energy dispersive X-ray fluorescence) mapping for geochemical, lithological and mineralogical studies

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Samples from selected mine tailings in northern Chile were geochemically, lithologically and mineralogically analysed by using the μ-EDXRF as a fast mapping method. Results were compared with more or less classical measuring methods to debate advantages and disadvantages of the μ-EDXRF.

Bulk composition of the samples was obtained by the elemental mapping of mineral concentrates and pressed pellets. The results were in good accordance with standard WDXRF analyses.

Additionally, a positive outcome in a detection of zones of metal enrichment or depletion as well as different lithological zones in drill cores was revealed by the geochemical mapping of the drill cores. The results were compared with data from LIBS (laser induced breakdown spectroscopy) analyses. Both methods are in satisfying quantitative agreement with each other for the majority of measured elements.

Mineralogical investigation was performed by using the elemental mapping of the mineral concentrates. The measured spectral data map was mineralogically classified with the SAM (spectral angle mapper) method of ENVI. The resulted mineral distribution map was evaluated by using the software “Petrographic Analyst” and qualitatively as well as quantitatively compared with a SEM-MLA. The principal primary and secondary mineral parageneses as well as size and shape of the grains obtained from μ-EDXRF and SEM-MLA showed acceptable agreement with each other. However, texture of the grains and distribution of minerals within the grains vary due to different spatial resolution, sampling volume, and geometry of the two instruments.

Nevertheless, the μ-EDXRF mapping is a needful method that can fill a gap between microscale and macroscale exploration methods because it is a fast and non-destructive method that allows the investigation of a large cut sample without any need for further sample preparation.