Evaluation of bulk rock nanoparticulate pressed powder pellet LA-ICP-MS analysis employing a binder

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A method combining the advantages of nanoparticulate pressed powder pellets (PPP) [1] and the addition of a mechanical and laser light absorbing binder [2] to achieve precise and accurate major to ultra-trace element analysis of bulk rock samples via 193 nm LA-ICP-MS is presented. Focus is put on unconventional fluid-tracers, e.g., B, As and Sb, and on trace elements not commonly measured. Various binders are evaluated, and Ca is used as an internal standard for data reduction. No bias factors [1] are used.

Tests involving 7 different binders reveal that for the most suitable one, microcrystalline cellulose (MCC), results are identical to those obtained from binder-free PPP. Consequently, non-cohesive materials can be pelletised via addition of MCC binder for LA-ICP-MS analysis. Procedural blanks are very low, demonstrating that MCC does not contaminate, thus allowing for the analysis of ultra-trace element concentration as e.g. present in serpentinites.

Accuracy and precision of the method are evaluated with the SRM powders UB-N (serpentinite), JP-1 (harzburgite), BCR-2 (basalt) and GSP-2 (granodiorite). Standard deviations (n=12) are < 10 %, often < 3 %, except for ng g^{-1} element concentrations. Data generally deviate <10 % from reference values. However, BCR-2 and GSP-2 show patterns relative to reference values indicative of higher magmatic differentiation degrees. These patterns are reproducible with different external standardisations (SRM 610, BCR-2G). Significant reference material batch inhomogeneities are thus indicated. Subordinate matrix effects induced by non-matrix matched external standardisation are also present and can be minimised by matrix-matched calibration.

This LA-ICP-MS PPP bulk rock method is particularly promising for minor to trace element concentration analysis for rocks containing difficult to dissolve minerals or for elements suffering from interference problems in liquid mode ICP-MS analysis.

[1] Garbe-Schönberg & Müller (2014) *J. Anal. At. Spectrom.*, **29**(**6**), 990-1000. [2] O'Connor et al. (2007). *J. Anal. Atom. Spectrom.*, **22**(**3**), 273-282.