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New calibration strategies for Laser Ablation Inductively Coupled Plasma Mass Spectrometry measurements on fused glass samples.

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Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA ICP-MS) has been used in this work, as a complementary multi-element technique, to the major element analyses with wavelength dispersive X-ray fluorescence (WDXRF). Most applications of the high sensitivity multi-element capability ICP-MS in the Earth sciences require digestions of solid samples with strong acid mixtures. These different digestion procedures (e.g. bomb and microwave digestions), for solution nebulization ICP-MS are normally time consuming, inaccurate, and dangerous. The most significant and common error that occurs during the decomposition of geological samples is an incomplete rock digestion since some minerals are resistant to acid attack (e.g. not achieving a total digestion of zircon).

The limitation of ICP-MS to analyze solid materials directly led to the development of in situ micro solid sampling methods as high-powered Laser systems. Laser emission is used to ablate material from the surface of the sample and to transport this ablated material to the ICP-MS.

The introduction of fusion as sample preparation technique in XRF around the middle of the last century was of special significance. For years, analytical geochemists have relied on lithium-metaborate/ lithium-tetraborate as fusion reagent in analyzing major elements by XRF in a wide range of rocks. Fusion has been established as an applicable sample preparation method as it provides a simple way of dissolving crystalline heterogeneous rock material to an amorphous homogeneous glass (solid solution). Fusion is not only disintegrating the sample matrix to a reproducible form but is also a

fast, precise and accurate method to eliminate small inhomogenities in the analytical sample.

The used sample preparation procedure for the spiked international geostandard beads was the routine bead technique for XRF major element analysis at the “Institute of Earth sciences Jena”, including an 11:1 ratio of the flux and sample, fusion in an induction-heated furnace, and cooling in a Pt-mould. This method is used since it allows the use of the fused glass beads for both XRF and LA ICP-MS without additional preparation steps. As a result, a large set of elements, including a number of elements with concentrations below the limits of detection (LoD) of the WDXRF can be measured by LA ICP-MS using the same solid solution bead sample. The high potential of LA ICP-MS on glassy beads for trace element determinations is demonstrated by comparison of the measured concentrations from international geostandards to the certified/recommended values. The proposed LA ICP-MS method profits of the speed and analytical precision of fusion, but is of cause not free from analytical problems and so LoD, reproducibility, deviations from reference values, as well as possible errors and related error sources are presented.