Reference values following ISO guidelines for 20 most frequently requested rock reference materials

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The GeoReM database contains analytical data of numerous rock reference materials (RMs) and statistics about the most accessed samples. Although many of them are considered as being some of the most valuable RMs available, their reference values were not determined by metrological procedures.

We therefore established new reference values and their uncertainties at the 95 % confidence level for 20 widely used rock RMs (e.g., BCR-1, BCR-2, BHVO-1, BHVO-2, W-2, BIR-1, JA-1, JA-2, JB-1, BE-N) following ISO guidelines. All analytical data from the GeoReM database published between 1995 and 2015 were used. The number of individual data for each rock RM varied between about 1000 (JA-1, JB-1) and 5000 - 6000 (BHVO-2, BIR-1, BCR-2). Partly more than 100 – 200 single analytical results (e.g., REE, Sr, Ba, Pb) were available for each RM.

Reference values which are comparable to certified values in a recertification programme were obtained by averaging the mean analytical results of the different laboratories. Some data were not used for these calculations, because they were inappropriately calibrated and/or have low precision and/or they did not fulfil the Horwitz requirement for outliers. Isotope dilution is considered to be a primary method having the highest metrological significance. We used at least 5 isotope dilution data from different laboratories to derive a reference value. In cases where less than 5 isotope dilution data exist, we averaged all data of techniques with a high level of confidence (e.g., ICP-MS, AAS, XRF). We report reference values, when they are derived from at least 7 laboratories and the number of methods is at least two.