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Forgetting What We Know About Lithium Isotopes Could Have a Big Impact on Estimates of Mineral Content

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It has long been recognized, both within and beyond the geochemistry community, that lithium isotope compositions exhibit significant natural variation. Considerable research has focused on characterizing materials and documenting these differences in isotopic abundances. Despite this, such variability is frequently overlooked in routine determinations of total lithium content. Most primary calibration standards, including *SI*-traceable materials, are characterized almost exclusively by gravimetry and/or atomic emission spectrometry. When these standards are used for calibration in mass spectrometry analyses, it is often assumed that their isotopic compositions are identical to those of the samples being analyzed. Consequently, quantification typically relies on measurement of a single isotope, typically ^{7}Li, without correcting for variations in relative isotopic abundance.

In a screening of thirteen commercially available primary calibration standards, we observed substantial variation in $\delta_{LSVEC}(^{7}Li)$ values, ranging from -12 ‰ to 600 ‰. When such isotopic differences are not accounted for, calculated lithium mass fractions can deviate significantly from their true values. The extent of this deviation depends on the calibration approach used. Methods generally regarded as more robust, such as isotope dilution, were found to be more strongly affected than other techniques such as standard addition or external calibration. In extreme cases, neglecting differences in isotopic composition between samples and standards resulted in deviation exceeding 15 % from the true lithium content. In the context of raw material evaluation and resource assessment, such biases could have significant economic implications for the critical minerals industry.