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Limit of reproducibility in $\delta^{26}Mg$: Detecting subducted components in the mantle

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Mantle peridotites show a uniform $\delta^{26}Mg$ value of ~-0.25‰ with little variation (<0.1‰). However, subducting sediments with distinctly different values, e.g., carbonate sediments with isotopically lighter $\delta^{26}Mg$ or silicate sediments with isotopically heavier $\delta^{26}Mg$ may alter the Mg isotopic composition in the mantle. Volcanic rocks derived from this metasomatized mantle often carry the Mg isotopic signature of this mantle. Although, due to the large abundance of Mg in the mantle compared to the subducting sediments, the variation in $\delta^{26}Mg$ produced in the volcanics due to mixing of the subducted components to the mantle is often very small and comparable to limit of reproducibility. This problem is further magnified when we compare analysed values with published data from labs across the world. Compilation of $\delta^{26}Mg$ values from USGS volcanic rock standard BCR-2 (e.g., Teng et al., 2017[1]) show a wide range of values ranging from -0.09 to -0.37‰. Reported data in the GeoRem database also show a variation of 0.25‰ (-0.2 ~ -0.45‰) with 2σ greater than 0.2‰ (n=54). This suggests that volcanic samples measured as unknown would also show a similar uncertainty, which makes it difficult to conclude on the reliability and cause of small variations in volcanic rocks.

In recent years, the precision and reproducibility of $\delta^{26}Mg$ values are ever increasing with advancement of mass spectrometers and analytical procedures. To ascertain the uncertainty in measured values from volcanic rocks derived from the mantle, we measure multiple aliquots of common volcanic and mantle rock standards (BCR-2 & BHVO-2 from USGS, JB-2 & JP-1 from GSJ) to conclude on the variability in data due to analytical conditions. We also compile a database of values reported in the last five years on these rock standards to ascertain the reproducibility and comparability of data across labs. The analysed and compiled data from this work suggests that reproducibility of $\delta^{26}Mg$ increased in recent years and can be used to decipher subducted components in mantle derived basalts.

[1] Teng, F. Z. (2017). Magnesium isotope geochemistry. *Non-Traditional Stable Isotopes* **82**, 219–288.