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Magesium isotope analysis of carbonates using laser ablation MC-ICP-MS

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Micron-scale magnesium isotope compositions of carbonates play an important role in tracing geological and biological processes. Matrix effects of carbonates with distinct chemical and physical properties are the main factors affecting the accuracy and precision of Mg isotope analysis by laser ablation multi-collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS). This study investigates Mg isotope microanalysis of magnesite, dolomite and siderite under wet and dry conditions. The results showed that the main isobaric interference of $^{48}Ca^{2+}$ on $^{24}Mg^{+}$ in carbonate with high Ca/Mg ratios can be significantly suppressed and downhole isotopic fractionation can be reduced with the addition of water vapor before the ablation cell. MGS-3, DOL-8, DOL-9 and SD-5 show homogeneous in situ Mg isotope compositions with intermediate precision better than 0.14‰ and 0.15‰ for $\delta^{26}Mg$ and $\delta^{25}Mg$, and are adopted as in-house standards. The obtained in situ $\delta^{26}Mg$ and $\delta^{25}Mg$ values of matrix-matched samples were consistent with those determined by solution nebulization (SN)-MC-ICP-MS, and the associated uncertainties are 0.16-0.27‰ and 0.12-0.25‰ (2SD) under dry condition and 0.15-0.18‰ and 0.06-0.10‰ (2SD) under wet condition. This further indicates that water-assisted laser ablation analyses improved the analytical precision of Mg isotope determinations by 1.1 to 2.5 times. Inaccurate Mg isotope data were obtained under dry condition when carbonates were measured against a physical property and/or chemical composition different standard, such deviation can be largely improved in wet-laser analyses.