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In situ calcium isotopic ratio determination in calcium carbonate materials and calcium phosphate materials using laser ablation-multiple collector-inductively coupled plasma mass spectrometry

WEN ZHANG ¹, ZHAOCHU HU ^{*1}, YONGSHENG LIU ¹

¹ State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan 430074, China

ABSTRACT: This study presents a highly precise and accurate Ca isotope analysis method using laser ablation multiple collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) in calcium carbonates and calcium phosphates. High-sensitivity cones and nitrogen gas were used to improve the performance of the LA-MC-ICP-MS. Using the optimized instrumental conditions and correction strategies, an excellent within-run precision (< 0.06 ‰, 2SE) and external reproducibility (< 0.15 ‰, 2SD) for the microanalysis of $\delta^{44/42}\text{Ca}_{915\text{b}}$ were obtained in natural calcium carbonates and calcium phosphates. These precisions are better than the values previously reported in the literature regarding using LA-MC-ICP-MS. Matrix effects were observed during the in situ Ca isotope analysis among calcium carbonates, hydroxy calcium phosphates and igneous apatites. Using the matrix-matching standards, accurate $\delta^{44/42}\text{Ca}_{915\text{b}}$ values in natural materials with various matrices were achieved, confirming the availability of the proposed method to resolve the spatial variation of $\delta^{44/42}\text{Ca}$ in natural materials.

KEY WORDS: LA-MC-ICP-MS, Ca isotope analysis, calcium carbonate materials, calcium phosphate materials.