

CALCIUM ISOTOPIC COMPOSITION OF SEVERAL CHONDRITES

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Introduction: Calcium is a typical refractory incompatible alkaline element, with a 50% condensation temperature at 1517°K[1]. Calcium isotopic compositions of chondrites could be very helpful to understand the earlier evolution processes of the Earth, the origin and evolution of solar system materials, the building blocks of planets and the heterogeneity of the proto-planetary disk (e.g. [2], [3], [4]). Chondrites investigated in previous studies include CM, CR, CI, CO, CV, H, L, LL, EH, EL etc. Generally, carbonaceous-chondrite groups displayed a relatively wider range than other groups (e.g. [3], [4], [5], [6], [7]), and variations in a single chondrite could be bigger (e.g. Allende CV3). Obviously, this kind of variation directly reflected the heterogeneity in chondrite samples, and triggered debates in understanding the real isotopic signatures of calcium in chondrites. In this study, Murchison (CM2), Kainsaz (CO3.2), Allende (CV3), Vigarano (CV3), Leoville (CV3), LaPaz Icefield 03601 (H4) and Indarch (EH4) were selected to analyse their calcium isotopic compositions. Different from literature, we used a relatively bigger amount of samples (~0.5-2grams) and no pre-treatments were done after those samples were grounded. Note that the calcium isotopic compositions of Kainsaz, Leoville and LaPaz Icefield 03601 were probably not investigated and reported before.

Experiments: All the analyses were done in the State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences (GIG, CAS). Samples were grounded to 200 mesh and mixed well first. About 20–30 mg of the well-mixed powders were dissolved using a HF-HNO₃ (3:1) mixed acids following the procedure described in Zhu et al. (2016)[8]. The calcium concentrations were measured on an ICP-OES instrument. Calcium isotopes were measured on a Triton TIMS instrument, each sample was measured at least 3 times and precisions were given based on these repeated measurements. The long term precision of NIST 915a and seawater measured during the sample running period are all at ±0.12‰ level.

Conclusions: Our data are consistent with or falls into the range of the previous published data. All 3 CV3 chondrites displayed a limited range of calcium isotopic compositions, maybe indicate that analyses based on bigger sample amounts might be more representative because sample heterogeneity in small scales could be weighted and erased. If this is true, the variations of calcium isotopic compositions in carbonaceous chondrite groups could be smaller than the observed values. However, the difference between carbonaceous and non-carbonaceous is still there due to their different origins. Compared with the data reported in documents, our data for Indarch didn't show a higher $\delta^{44/40}\text{Ca}$ value, maybe because the sample was not rinsed with water and solute (e.g. oldhamite CaS) which might have a lower $\delta^{44/40}\text{Ca}$ value were retained.

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