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Constraining the mass-dependent Ti isotope composition of the chondritic reservoir – an inter-laboratory comparison study

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Titanium isotopes are a promising tracer for planetary differentiation processes. The application of this tracer is, however, currently hampered by the lack of a robust estimate for the chondritic reservoir. Previous studies revealed no significant mass-dependent Ti isotope variations (expressed as δ^{49}Ti, the permille deviation of ^{49}Ti/^{47}Ti from the OL-Ti standard) between major chondrite classes [1–3]. Yet, reported δ^{49}Ti averages systematically differ, ranging from +0.007 ± 0.010‰ (2SE, n = 15) [1], closely matching the Ti isotope estimate for the Bulk Silicate Earth (BSE) [4], to +0.074 ± 0.019‰ (2SE, n = 22) [2]. This inter-laboratory δ^{49}Ti difference is well beyond the quoted analytical precision of ±0.03‰ and may result from sample heterogeneity, or analytical artefacts related to sample processing and analysis.

Here, an inter-comparison Ti isotope study of four laboratories was conducted with the aim of providing an accurate and precise estimate for the chondritic reservoir and evaluating potential sources of inter-laboratory δ^{49}Ti variations. For this purpose, ordinary chondrites were selected to mitigate uncertainties related to the necessary corrections for nucleosynthetic isotope anomalies in chondrites and to further allow analysis of sufficiently large sample sizes representative of the bulk. The samples were distributed as powders, fused glasses, and aliquots of Parr bomb dissolved meteorite. The participating laboratories applied their own ^{47}Ti-^{49}Ti double-spike technique, utilising various sample digestion and ion-exchange procedures. Titanium isotope averages for ordinary chondrites defined by the different laboratories are in good agreement with each other. After correction for nucleosynthetic variations, the tentative average Ti isotope composition of all ordinary chondrites measured in this study is δ^{49}Ti = +0.026 ± 0.020‰ (2SD, n = 10). These results will be discussed in the framework of the growing body of Ti isotope data for primitive mantle-derived magmas. A revised estimate of the Ti isotope composition of the BSE will be presented.

[1] Greber et al. (2017) *GCA* 213, 534–552. [2] Deng et al. (2018) *GCA* 239, 409–419. [3] Williams et al. (2021) *Chem. Geol.* 568, 120009. [4] Millet et al. (2016) *EPSL* 449, 197–205.