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Iron isotope signatures of distal impact spherules from the Cretaceous-Paleogene boundary

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In the past years, non-traditional stable isotope systems have been applied to impact spherules to determine the nature of the impactor and decipher the complex processes taking place during large impact events such as melting, evaporation, condensation, mixing and ablative evaporation during atmospheric re-entry [1;2;3].

In this study, we determine the iron isotope compositions of 19 distal impact glassy spherules (microtektites) from the Cretaceous-Paleogene (K-Pg) boundary, presumably originating from the Chicxulub crater, by using a MC-ICP-MS Neptune Plus, after ion exchange chromatography [4]. The microtektites originate from the Beloc locality (Jacmel highway, Southern Peninsula of Haiti) and are petrologically and geochemically well-defined [5]. A major point of attention in this study is to analyze pristine materials, as Fe isotope compositions of the spherules can be severely affected by alteration processes [6]. To remove any trace of secondary alteration and recover pristine glass cores from microtektites, leaching procedures relying on EATG and dilute HCl were optimized and applied to small sets of impact spherules.

We observe no systematic isotope fractionation related to the leaching processes. Most of the microtektites from the Beloc localities display a mean δ^{57}Fe of 0.13 ± 0.13 ‰, which is comparable to the mean value of the upper crust [7]. Five of the microtektites display lighter Fe isotopic compositions with δ^{57}Fe as low as - 0.51 ± 0.15 ‰, which might be due to remaining alteration products within the glassy spherules. We show in this study that the iron isotope compositions of these glassy impact spherules, when not altered, appear to reflect the nature of the impacted crust and potentially the nature of the impactor rather than highlight any complex processes associated to hypervelocity impact events.

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