Te isotope fractionation in iron meteorites reveal near-equilibrium conditions during volatile loss

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Magmatic iron meteorites sample the metal cores of differentiated planetesimals. They are classified into groups by different contents of the moderately volatile elements (MVE) Ge and Ga, relative to Ni. The order-of-magnitude MVE depletions either are inherited from an iron parent body's precursor material, or are the result of secondary losses. To better constrain the nature of these MVE depletions, we obtained mass-dependent Te isotopic compositions for metal and troilite from several magmatic irons (IC, IIF, IIIAB, and IVA), using a ^{123}Te-^{125}Te double-spike and MC-ICP-MS. In all samples, Te is predominantly hosted in troilite, which therefore records the Te isotope composition of the bulk iron meteorite and likely the parent body. Despite large differences in Te concentrations, the troilites show only limited mass-dependent Te isotope variations, which fall within the range observed for chondrites. This indicates that an iron's Te isotope composition predominantly reflects that of its chondritic precursor material, while the much stronger Te depletions observed for some irons reflect secondary losses. These did not induce any significant isotope fractionation and, therefore, occurred under near-equilibrium conditions.