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Ruthenium isotope anomalies in meteorites and the origin of the late veneer

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The higher-than-expected abundances of highly siderophile elements in the Earth's mantle are thought to reflect the addition of a late chondritic veneer after cessation of core formation. The source of the late accreted material has proven difficult to identify, however. To address this issue we obtained Ru isotope data for chondrites (carbonaceous & ordinary) and iron meteorites. All samples exhibit nucleosynthetic Ru isotope anomalies indicating a deficit in *s*-process Ru in the meteorites relative to terrestrial Ru. The Ru isotope anomalies are correlated with Mo isotope anomalies in the same samples and all meteorites plot on a single Mo-Ru isotope mixing line between a presumed *s*-process carrier and terrestrial Mo and Ru. While the Mo isotopic composition of the Earth's mantle reflects that of the material added during the main stages of accretion, the Ru isotopic composition of the mantle was set by the late veneer. The observation that the silicate Earth plots on the Mo-Ru correlation defined by meteorites, therefore, indicates that the late veneer derives from the same Mo-Ru isotopic reservoir than the bulk Earth.

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