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Tracing the origin and evolution of volatile elements in the inner solar system by selenium isotopes

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To constrain the origin and evolution of moderately to highly volatile components on the rocky planets of the inner solar system we studied isotope variations of the moderately to highly volatile, chalcophile, and siderophile element Se and its abundance in meteorites as well as terrestrial and lunar materials. The Earth, the Moon, and most meteorite groups are depleted in volatiles compared to CI chondrites, either due to an evaporative loss during their formation or due to an incomplete accretion of solar nebular material. The $\delta^{82/76}$Se of chondrites is identical within the measurement uncertainty with a mean of -0.20 ± 0.26‰, pointing to a quantitative condensation of Se from the solar nebular. The Earth`s mantle has a $\delta^{82/76}$Se of 0.20 ± 0.43 ‰ and is therefore indistinguishable from the meteorite data. This could be explained by i) the absence of significant isotope fractionation during Se core segregation or ii) an overprint of the $\delta^{82/76}$Se mantle signature by Late Veneer material. Lunar soils are distinctly heavier in $\delta^{82/76}$Se by up to 12‰ due to an evaporative loss of volatiles.

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